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(BAW—10074A(Rev.1))
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Volume 4, Number 21, November 15, 1979

ENERGY RESEARCH ABSTRACTS

COAL AND COAL PRODUCTS

50926 (CONF-7606131—, pp 273-276) **Role of the university in lignite research and development.** Kaiser, W.R. (Univ. of Texas, Austin). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

Geology, utilization, and environmental aspects workshops were held concurrently to help evaluate the university's role in lignite research and development. They are reviewed in the order listed. Overlap of disciplines occurs and is common between utilization and environmental aspects where separation is especially difficult in the pollution-control area. Research topics are listed in tables. All are topics the university should be involved in, but it is not because of limitations of one kind or another. University capability to do the indicated research was assessed subjectively in the general context of Gulf Coast universities and specifically with respect to Texas universities. Only those topics believed to be within present university capability were ranked; rankings reflect the immediacy of the problem.

50927 (IS—4703) **Fossil Energy Program. Technical progress report, January 1—March 31, 1979. I. Mining Research and Development: Coal Preparation and Analysis.** (Ames Lab., IA (USA)). Jun 1979. Contract W-7405-ENG-82. 31p. P 03/MF A01.

Three sections of this report (Microstructure of Coal, Rapid Analysis of Mineral Content of Coals-on-Line Monitoring for Pyrite and Ash, and Blending Experiments) have been entered individually into EDB and ERA. (LTN)

50928 (ORNL—5520) **Fossil energy program. Quarterly progress report for the period ending December 31, 1978.** McNeese, L.E. (Oak Ridge National Lab., TN (USA)). Apr 1979. Contract W-7405-ENG-26. 280p. P 13/MF A01.

This quarterly report covers the progress during the period October 1 through December 31 for the Oak Ridge National Laboratory research and development projects carried out in support of the increased utilization of coal and other fossil fuel alternatives to oil and gas as sources of clean energy. These projects are supported by the DOE Divisions of Fossil Fuel Processing, Fossil Fuel Utilization, Fossil Fuel Extraction, Systems Engineering, Basic Energy Sciences, and Health and Environmental Research, and by the EPA Office of Research and Development through interagency agreement with the DOE.

50929 (ORNL/TM—6666) **Fossil energy program. Progress report for October 1978.** McNeese, L.E. (Oak Ridge National Lab., TN (USA)). Jan 1979. Contract W-7405-ENG-26. 65p. P 04/MF A01.

This report - the fifty-first of a series - is a compendium of monthly progress reports for the ORNL research and development programs that are in support of the increased utilization of coal and other fossil fuel alternatives to oil and gas as sources of clean energy. The projects reported this month include those for coal conversion progress development, material engineering, alkali metal vapor topping cycles, a coal equipment test program, an AFB coal combustor for cogeneration (CCC), engineering and support studies, process and program assistance, environmental assessment studies, magnetic beneficiation, and AFBC demonstration plant.

50930 **Status of peat research in Minnesota.** Franham, R.S. (Univ. of Minnesota, St. Paul). pp 21.1-21.11 of Fiftieth annual meeting of the Minnesota Section, AIME; thirty-eighth annual mining symposium. Graven, L.K. (comp.). Minneapolis, MN; Univ. of Minnesota (1977).

From 38. mining symposium; Duluth, MN, USA (12 Jan 1977).

Peat has a number of uses. When and where development of Minnesota peatlands will occur is not known. There are many potential uses of peatlands and the paper attempts to evaluate the past, present and future research efforts that would be helpful in making this development a reality. Peatlands can be utilized in agriculture for the production of food and fiber crops and for harvesting of horticultural-type peat as soil conditioners and growing mixes. They are potentially suitable for the production of energy either as direct fuel sources or for conversion to synthetic gas. They are well suited to cropping of cattails, sedges and grasses as sources of biomass production on energy farms. Peats and peatlands can be used for wastewater filtration, sludge disposal and for removal of toxic heavy metal pollutants from effluents. They also are a potential source of organic chemicals as a substitute for present petrochemicals. Conservation and preservation of some of our peatlands should also be a high priority in any planning decisions. Development of new sources of energy, possible biomass or peat, is urgently needed now. Conversion processes to gas or solid fuels may soon be a feasible alternative. Perhaps most important of all, consumers of energy must give serious and practical consideration to public decisions that must be made relative to energy resources and environmental concerns. These decisions will not be easily made.

PROCESSING

50931 (IS—4655) **Fossil Energy Program. Technical progress report, October 1—December 31, 1978. I. Mining Research and Development-Coal Preparation and Analysis. II. Advanced Research and Technology Development.** (Ames Lab., IA (USA)). May 1979. Contract W-7405-ENG-82. 112p. P 06/MF A01.

This report covers objectives and progress for eight areas of the Ames Laboratory Fossil Energy Program. Separate sections were abstracted and indexed individually.

50932 **R/D selection by leverage.** Tsou, P. (Jet Propulsion Lab., Pasadena, CA). pp 527-542 of Symposium papers: energy modeling and net energy analysis. Chicago, IL; Institute of Gas Technology (1978).

From Conference on net energy analysis and energy modeling; Colorado Springs, CO, USA (21 Aug 1978).

Since all coal-conversion processes require coal-feed systems, a judicious selection of a set of coal-feed systems for current development will enhance the achievement of a synthetic-fuel industry in this country within this century. This paper presents a coal-feed system research/development (R/D) selection model. This model was used to help in the selection of coal-feed-system concepts for the pilot-scale phase of the Coal Feeder Program within the Division of Fossil Energy of ERDA, now DOE. This model ranks the various coal-feed-system concepts according to an R/D leverage which includes the following considerations: feed system life-cycle cost, R/D investment, technical design feasibility, feeding performance, design-scaling effects, and parallel feed system developments. The R/D leverage is a simple measure of the expected savings on R/D investment by developing the feed system with respect to a selected baseline feed system, i.e., lockhopper. The expected savings are the product of the difference in life-cycle costs between the evaluated feed-system concept and the selected baseline feed system and a quantitative measure of the realizability of the feed system concept. Realizability includes consideration of the technical design feasibility, design scaling tradeoffs, and the stage of development. This R/D leverage model is readily applicable to other similar evaluation and selection situations.

DESULFURIZATION AND PURIFICATION

REFER ALSO TO CITATION(S) 50958, 50971, 50989, 50992, 51016, 51028, 51030

50933 (CONF-7606131—, pp 266-272) **Coal preparation versus stack-gas scrubbing to meet SO_2 emission regulations.** Schaeffer, S.C. (Skelly and Loy, Camp Hill, PA). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

Sulfur dioxide emission control has received extensive attention as a research subject by the coal industry and governmental regulating agencies. Several approaches have been proposed to meet emission control; however, only two are currently feasible on a commercial scale for the hundreds of coal-fired powerplants in operation or under design: (1) coal preparation to reduce pyritic sulfur and, (2) desulfurization of powerplant flue gases. Which of these two approaches, when exposed to an engineering economic analysis, will result in the lower owning and operating cost per ton of coal burned? What effect will variables such as coal seam, percentage of pyrite removed, new versus existing powerplant design, or type of scrubber system employed have on the analysis? These are questions this paper answers. The study also explores the combined use of both methods to evaluate costs and environmental problems. Pennsylvania was used as the area of in-depth investigation to make possible a detailed study of coal reserves and the electric generation market for these reserves. United States Environmental Protection Agency air standards were compared to Commonwealth standards to measure the impact each approach has on air-quality regulation and coal reserve utilization. The last section of the paper is a discussion of environmental regulation constraints on the utilization of Gulf Coast lignites. Additional research needs are discussed.

50934 (FE—2295-32-6) **Medium and high temperature gas clean-up of particulates. Quarterly progress report, January—March 1979.** (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Apr 1979. Contract EX-76-C-01-2295-032. 16p. P 02/MF A01.

Corona charging and electropacked bed collection experiments have been carried to 1350°F. It was possible to obtain stable corona discharge up to this temperature although corona initiation and sparkover voltage decreased rapidly with increasing temperature. Redispersed fly ash was charged and collected with collection efficiencies in excess of 99% at temperatures up to 1150°F. At higher temperatures, collection efficiency drops to the efficiency of a packed bed without electrical augmentation.

50935 (FE—2645-02) **Deasphalting, deashing, and upgrading of coal liquids. Quarterly technical progress report, January—March 1979.** Riedl, F.J.; deRosset, A.J. (UOP, Inc., Des Plaines, IL (USA). Corporate Research Center). May 1979. Contract EF-77-C-01-2566. 14p. P 02/MF A01.

Feedstock for Demex deashing of coal liquids was prepared by liquefying a slurry of Illinois No. 6 coal in a coal-derived solvent. Of the moisture free slurry fed, 95% was obtained as feed to the Demex unit. The remainder was C_5- light ends. Coal conversion on a MAF basis was 92.5%. The Demex operation has been completed after overcoming problems with the bottoms product transfer system. The results are currently being evaluated and product analyses are in progress. The hydrotreating of the Demex product is to be started in early May.

50936 (IS—4655, pp 1-8) **Advanced development of fine coal desulfurization and recovery technology.** Wheelock, T.D.; Markuszewski, R. (Iowa State Univ., Ames). May 1979.

In Fossil Energy Program. Technical progress report, October 1—December 31, 1978. I. Mining Research and Development-Coal Preparation and Analysis. II. Advanced Research and Technology Development.

The process based on leaching fine size coal with a hot alkaline solution containing dissolved oxygen under pressure was investigated further with respect to the removal of sulfur, especially organic sulfur, at four different temperatures and three different oxygen partial pressures. Additional work on flotation and selective oil agglomeration is reported. The large bench-scale flow system for demonstrating the cleaning and recovery of coal fines by froth flotation, oil agglomeration and pelletization is undergoing modifications. (LTN)

50937 (IS-T—872) **Desulfurization of coal-derived pyrite using solutions containing dissolved oxygen.** Chen, M.C. (Ames Lab., IA (USA)). Jul 1979. Contract W-7405-ENG-82. 108p. P 06/MF A01. Thesis.

The effect of alkaline solutions containing dissolved oxygen on coal-derived pyrite was investigated in a tubular reactor. The rate of total sulfur conversion seems to be affected by oxygen partial pressure, oxygen flow rate, particle size, pyrite charge size and system temperature. A shrinking core model was chosen to represent this chemical leaching process. From the results obtained, it seems that ash or product-layer difusion is the rate-limiting step for leaching with the alkaline solution/oxygen system. The effective diffusivity is about 10^{-5} cm^2/sec. The apparent activation energy for this process is 7.97 kcal/mole in the temperature range from 121° to 175°C. For the tubular reactor system used, the rate of sulfur extraction appears to be proportional to the oxygen partial pressure. The rate of conversion increases as the oxygen flow rate decreases to a limit of 3 ml/sec. The rate also increases as the pyrite charge size decreases. The leaching solutions flow rate has a negligible effect on the total sulfur conversion.

HYDROGENATION

REFER ALSO TO CITATION(S) 51006

50938 **Mechanochemical effects in coal conversion--1. Coal hydrogenation in gaseous hydrogen aided by mechanical energy.** Yang, R.T. (Brookhaven Natl Lab, Upton, NY). *Fuel;* 58: No. 4, 242-246(Apr 1979).

Hydrogenation experiments with a Pennsylvania anthracite coal were carried out in H_2 under the following conditions: with simultaneous grinding; with grinding and the addition of 1% tin; without simultaneous grinding; and without grinding but with the addition of SnCl;sub 2; (1% Sn). Temperature was maintained at 442;degree;C. By eliminating or minimizing the effects of heating that were due to grinding, and of size and mass transfer, the net effects on hydrogenation of the above conditions were examined. SnCl;sub 2;, as expected, increased the light products, both gaseous and liquid. Grinding substantially increased the heavy oil products. 23 refs.

GASIFICATION

REFER ALSO TO CITATION(S) 50934, 51010, 51019, 51021, 51024, 51054, 51061, 51807, 51843, 51912, 52132

50939 (CONF-790630—) **Proceedings of the 5th underground coal conversion symposium.** (Department of Energy, Washington, DC (USA). Div. of Fossil Fuel Extraction). May 1979. 451p. P 20/MF A01.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

The 5th underground coal conversion symposium was held at Alexandria, Virginia, June 18—21, 1979. Thirty-three papers have been entered individually into EDB and ERA. Seven papers were also abstracted for Energy Abstracts for Policy Analysis. Seven papers had been entered previously from other sources. The symposium was sponsored by the US Department of Energy, Division of Fossil Fuel Extraction. (LTN)

50940 (CONF-790630—, pp 1-9) **National Underground Coal Conversion Program overview.** Draffin, C.W. (Dept. of Energy, Washington, DC). May 1979.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

After providing perspective on the United States Underground Coal Conversion Program, this paper describes the US coal resource, the technology for gasifying coal underground, the markets for Underground Coal Gasification and American industry's recent active interest. The key issues in Underground Coal Gasification are addressed along with the DOE activities, priorities and management approach to resolve them.

50941 (CONF-790630—, pp 11-23) **Field implementation of UCC research.** Brandenburg, C.F. (Laramie Energy Tech. Center, WY). May 1979.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

A review of the total field testing effort to date in the Department of Energy Underground Coal Conversion program is presented. Since its inception in 1972, this program has validated and significantly extended the state of the art that was primarily available from pre-1965 Soviet publications. In general, the results of the field tests have been very positive, and indicate strongly that UCC could be used commercially in this country before 1990. Some problems have been encountered with linking techniques and override situations; further work on these problems is required. A distinguishing feature of the DOE program has been the development and use of sophisticated diagnostic instrumentation, which has led to a much more quantitative understanding of the process than was previously possible. Further efforts in this area are also planned.

50942 (CONF-790630—, pp 31-41) **Role of underground coal conversion in the United States energy future.** Wieber, P.R. (Dept. of Energy, Washington, DC). May 1979.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

This paper presents a perception of the role of Underground Coal Conversion (UCC) in the Department of Energy Research and Development program and in the nation's energy future. The near-term energy situation is discussed. The UCC program and its relationship of UCC to other Fossil Energy programs is described. The impacts of achieving some of UCC potential advantages are outlined in terms of economics, environmental impacts, and resource utilization. Speculations are made on possible future developments in the technology and on its deployment in a national energy production/distribution/consumption system. The result is an optimistic answer to the question, Why Underground Coal Gasification?

50943 (CONF-790630—, pp 43-51) **Department of Energy's 1979 Underground Coal Conversion Program.** Zukor, S.H.; Burwell, E.L. (Dept. of Energy, Washington, DC). May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

An introduction to Underground Coal Gasification is provided including an explanation of the basic process, advantages and disadvantages, market targets, and economics. The need for a federal role is explained and the current DOE program is described, highlighting objectives, accomplishments, problems, and plans. Results to date have been consistent with the potential advantages claimed and all remaining problems are yielding to further technology development and scale up. DOE concludes that continued aggressive development will lead to commercial processes by the late 1980's. Not many people realize that only about 7% of our nation's vast coal resource can be recovered by conventional underground and strip mines. The other 93% is too deep, too thick, too thin, too wet, too highly faulted, lies in steeply dipping beds, or under unavailable land, has too much ash, or has too unstable an overburden to allow mining. Conservative estimates show that at least an additional 21% of the resource can be recovered using UCG. In other words UCG could easily quadruple our recoverable coal resource. Criteria for selecting coal deposits for underground gasification are given. (LTN)

50944 (CONF-790630—, pp 53-66) **Initial results from a linked vertical well field test in bituminous coal.** Strickland, L.D. (Morgantown Energy Tech. Center, WV); Martin, J.W.; Liberatore, A.J.: Zielinski, R.E.; Seabaugh, P.W. May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

The Morgantown Energy Technology Center (METC) is conducting a project to develop the technology required for a viable in situ gasification process to recover energy from thin seam, swelling, unminable bituminous coal. As one initial step to achieving this goal, METC, with support from Mound Facility, is conducting a field test to determine the applicability of adapting the Linked Vertical Well (LVW) technology (with air injection), which has proven successful in the recovery of thick seam sub-bituminous coal, to the recovery of the bituminous coal resource. Construction of the test facility near Priceton, West Virginia, is complete and operations to prepare the coal seam for the gasification phase of the test are in progress. Equipment and piping design are reviewed in relation to the test strategy to prepare and gasify a 100 ft. (30 m) section of the 6 ft. (2 m) thick, 900 ft. (275 m) deep Pittsburgh coal seam. The characterization of the coal seam, the environmental monitoring program, and pre-ignition testing is discussed.

50945 (CONF-790630—, pp 91-102) **Site selection and characterization for an underground coal gasification process.** Bartel, L.C. (Sandia Labs., Albuquerque, NM). May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Geologic and hydrogeologic features influence the success of the underground coal gasification (UCG) process. It is desirable to perform the UCG process at sites having optimal conditions, or at least the site detailed to take advantage of geologic and hydrogeologic features. A site selection and characterization program is taking place in the State of Washington and elements of this program are outlined in this paper. The selection and characterization studies for a commercial UCG process need to be economical which precludes the extensive use of borehole surveys. The program outlined helps to establish criteria for the use of less expensive surface techniques in the initial site selection and characterization phases for a commercial process and to establish adequate characterization procedures which require a minimum number of boreholes. Examples will be given of information obtained from surface geophysical techniques employed at the Hanna IV site and the Gulf site west of Rawlins, WY, and examples will also be given of information that can be obtained from well logs.

50946 (CONF-790630—, pp 103-108) **Tennessee Colony In Situ Gasification Project: a review.** Haney, S.E. (Basic Resources Inc., Dallas, TX). May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

The Tennessee Colony Project was composed of two phases, air injection and oxygen/steam injection. The project gasifier consisted of a multichannel, multiwell configuration utilizing the reverse combustion linkage technique in a thin wet lignite seam. This paper contains field data and preliminary results from the air injection phase.

50947 (CONF-790630—, pp 109-117) **Tennessee Colony steam—oxygen in situ lignite gasification test.** Grant, J.F. (Basic Resources Inc., Dallas, TX); Fernbacher, J.M. May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

A technical feasibility field test on steam-oxygen in situ gasification of Texas lignite has been carried out by Basic Resources Inc., and Air Products and Chemicals, Inc. This paper reports the preliminary results of the joint test program. Two test burns were made in a four-well parallel operation. Gas with a higher heating value up to 265 Btu/SCF was produced during the test and an average value of 230 Btu/SCF was obtained during the main part of the steam-oxygen burn. Steam-oxygen volumetric ratios between 0.5 and 4.0 were used. Economic and engineering evaluations of the test data are now being carried out to estimate the potential for steam-oxygen in situ lignite gasification technology and to determine the direction of possible future work.

50948 (CONF-790630—, pp 119-126) **Joint Belgian-German U.C.G. - field test in deep-lying coal deposits.** Ledent, P.; Beckervordersandforth, C.P. May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

The solid fuel resources of Western Europe limited to a depth of about 1,200 m can be assessed at 400 milliard tons, but the vastness of the coal-measures at very great depth is still much higher. In the sole part of Europe lying on the perimeter of the North Sea, the most recent geological data allows us to evaluate at several thousands of milliards tons the amounts of coal situated between 1,200 and 5,000 m of depth. The experiment of underground gasification which is proposed at the present, aims at ensuring the working of these deep deposits by means of a manless method derived from the oil techniques and which should make it possible to obtain, at will, a low Btu gas for the supply of the power-stations, a medium Btu gas for chemical purposes or a substitute natural gas for all the developments of the carbochemistry. This objective is of major interest for all countries of the European Community owing to their present great energetic dependence and owing to the high cost of coal produced by conventional methods. Preliminary studies for the development of UG at great depth are in progress in Belgium and in the Federal Republic of Germany, and the Governments of both nations have signed an agreement with a view to developing the technical and economic conditions for industrial application of the process at great depth and under high pressures. Greater depth can bring three major advantages for underground gasification: the lack of water; the tightness of the rocks; and their capacity to withstand very high pressures. The use of high pressures should allow: achievement of large gas flows in small-diameter wells; improved thermal balance through reduction of the heat lost in the rocks; decrease of the amount of energy consumed to counterbalance the load losses in the underground circuits; and increase of the heating value of the gas by increasing the production of methane. (LTN)

50949 (CONF-790630—, pp 127-137) **Overview of in situ lignite gasification.** Hand, J.W. (Pace Co. Consultants & Engineers, Inc., Denver, CO). May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Lignite has physical, depositional and locational characteristics that make it the premier coal for development by in situ technology. The major resources of lignite are in the Gulf Coast and Northern Great Plains Provinces. A method for selecting between available deposits based on relative costs of production of low Btu gas is presented. The market for in situ lignite gasification is forecast to increase at a greater rate than the market for all energy production.

50950 (CONF-790630—, pp 139-145) **Low and medium Btu gasification: a chemical industry perspective.** Sashirara, T.F.; Canby, T.D.; Quinn, R.S.; Sensing, T.A.; Strungis, S.W.; Wellborn, S.G. (E.I. du Pont de Nemours & Co., Inc., Wilmington, DE). May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

A chemical industry perspective of the uses and value of the gaseous products obtainable from underground conversion of coal is presented. Discussed briefly is its use as a syngas source for conversion to chemical products. Also, its value as a boiler fuel opposite alternate fuel is analyzed. It is concluded that the medium Btu gas (MBG) derived when converting coal by oxygen injection can be attractive for both feedstocks and fuel use by the chemical processing industries. The usefulness of the low Btu gas derived when injecting air is much more limited. Underground conversion of coal to MBG merits increased emphasis. From our perspective, medium Btu derived from oxygen is the lowest cost alternative for industrial fuels derived from coal gasification. It is broadly equivalent to SNG as a fuel and is transportable moderate distances. Again, as a fuel, MBG has broader utility than LBG, especially in retrofit applications. As a feedstock it is the preferred option for the reasons discussed, if the methane content is low. MBG can have substantial market potential as a boiler fuel due to its high value-in-use relative to the alternative fuels and its environmental attractiveness. Published cost estimates indicate that it may be possible for MBG to sell at a price which would be economically attractive to both the user and the producer. Thus, MBG represents a potentially viable means of utilizing coal via in situ gasification. (LTN)

50951 (CONF-790630—, pp 147-162) **Economics of producing gasoline from underground coal gasification synthesis gas.** Edwards, M.S.; Ulrich, W.C.; Salmon, R. (Oak Ridge National Lab., TN). May 1979.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

A conceptual process design and cost estimate is presented for a facility producing approximately 15,000 barrels per day of M-gasoline via methanol from synthesis gas generated by underground gasification of coal. The design was based on experimental data and mathematical predictions from the Laramie Energy Technology Center on the linked vertical well UCG process. In-place subbituminous coal consumption is 20,000 tons/day. The capital investment was estimated to be $535 million (first quarter 1978). M-gasoline product price was calculated as a function of financing approach, in-place coal cost, and plant factor. At a 70/30 debt/equity ratio, 9% debt interest rate, after-tax 15% return on equity, $5/ton in-place coal cost, $4/10^6 Btu propane by-product credit, and 90% plant factor, the product price of M-gasoline (including butene LPG) is about $0.90/gas (plant gate). The sensitivity analyses provided permit the interpretation of study results for widely different technical and economic assumptions.

50952 (CONF-790630—, pp 177-190) **Chemical industry can benefit from underground coal gasification.** Mason, R.Z. (Williams Brothers Engineering Co., Tulsa, OK); Hegarty, P. May 1979.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Gas obtained from burning coal underground can be instrumental in providing a chemical plant synthesis gas or an intermediate heating value fuel gas to the chemical industry. Dwindling natural gas supplies and the threat of usurpation of long term supplies of existing fuel and feed stocks are causing the chemical industry to look to alternate sources for future supplies. Recent technical development and economic appraisal indicate that underground coal gasification has a viable opportunity to provide some portion of future energy requirements to the chemical industry. Environmental issues and capital requirements indicate that underground processing may be the preferred method for extracting future energy supplies from coal.

50953 (CONF-790630—, pp 191-198) **Economic evaluation of underground coal gasification.** Sikri, A.P. (Dept. of Energy, Germantown, MD). May 1979.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

This paper deals with a comprehensive analysis of previous cost studies. The cost data have been brought to a standardized data base. This data base includes the size of the plant, financial parameters, cost of labor, cost of coal, and some other similar costs. The inflation factors have been included to bring them all to the April 1979 level. Wherever appropriate, the underground coal gasification process has been compared with mining and surface gasification (based on Lurgi process) to compare the cost of these two technologies on an equal footing. The total capital requirements and the product shadow selling price have been reported. The shadow selling price in this case provides a 17 percent return on investment. The costs are based on onsite manufacture of electrical power, medium-Btu gas (~ 400 Btu/scf), methanol and ammonia synthesis gas, and synthetic natural gas from gasification of western coals (Rockies region).

50954 (CONF-790630—, pp 199-211) **Helium tracer studies to characterize underground flow paths.** Ahner, P.F.; Genser, R.W. (Gulf Research & Development Co., Harmarville, PA). May 1979.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Helium tracer studies provide a means for determining the mean residence times of gases in subsurface voids. From mean residence time, the active void volume and the presence of multiple paths can be inferred. Helium tracer data was obtained at the LETC Hanna IV UCG site in Wyoming during reverse burn linking and throughout the gasification phase. Void volumes are compared to those obtained from material balance calculations as well as from other tracer test data. A qualitative description of the flow path and how it changes during the UCG test is presented. Helium tracer studies were also made at the Rock Springs in situ oil shale retort site in order to determine the flow distribution in LETC's six-spot well pattern prior to ignition. The tracer test system hardware and data interpretation techniques are discussed.

50955 (CONF-790630—, pp 221-243) **Pricetown I instrumentation and preliminary data.** Zielinski, R.E. (Mound Facility, Miamisburg, OH); Seabaugh, P.W.; Agarwal, A.K.; Martin, J.W.; Liberatore, A.J.; Strickland, L.D. May 1979.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Underground coal gasification (UCG) offers a unique means of recovering energy from coal in an environmentally acceptable manner without the necessity of mining. A field test in bituminous coal is currently in progress at the Morgantown Energy Technology Center's Underground Coal Gasification test site near Pricetown, West Virginia, with the primary objective of testing the viability of the Linked Vertical Well technology to recover the 275m deep 2m thick swelling bituminous coal resources. The field process is being continuously monitored in real time by an acquisition and control system comprised of a host minicomputer and four satellite microprocessors. The analytical instrumentation system contains two gas chromatographs, a mass spectrometer and an NO/sub x/ analyzer. Efficient use of the gas chromatographs is realized by time sharing them among five gas sources; four monitoring wells and the product stream. The control logic resides in the microprocessor controlling the mass spectrometer because of the greater analysis speed of the mass spectrometer; it can be stream switched approximately every 2 1/2 minutes. One of the chromatographs will provide real time water analysis. Real time graphic displays generated by the computer system will be presented. Likewise, initial test data will be presented.

50956 (CONF-790630—, pp 245-252) **Development of a three-dimensional simulator for cavity growth during underground coal gasification.** Riggs, J.B. (Univ. of Texas, Austin); Edgar, T.F.; Johnson, C.M. May 1979.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

A three-dimensional model is being tested to determine its capability for predicting sweep efficiency as a function of coal composition and other physical properties, water influx, and seam thickness. The model is written in rectangular coordinates and thus simulates burnout from an initial linkage channel for a horizontal coal seam and uniform thickness. The pseudo-steady state assumption permits the simulation of cavity growth. Principal equations include gas species equations and both solid and gas phase energy balances. The temperature profiles are coupled with the reaction rate equations, thus producing oxidation and reduction zones in the channel. Convective mass transport coefficients at the coal face account for dispersive mass transfer effects. The general structure of the model will be presented along with numerical results. The convergence scheme used to solve iteratively the mass and energy balances will be discussed.

50957 (CONF-790630—, pp 253-267) **Geophysical survey characterization of underground coal gasification sites near Pricetown, West Virginia.** Kirk, K.G. (Dept. of Interior, Denver, CO); Rauch, H.W.; Gillmore, D.W. May 1979.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Resistivity and reflection seismic surveying were used as aids in characterizing the geologic environment of the underground coal gasification (UCG) sites near Pricetown. Resistivity surveying using the tri-potential technique located two prominent and six minor vertical fracture zones at the UCG sites. The prominent fracture zones are 1000 to 2000 feet (305 to 610 m) long, over 40 feet (12 m) deep, and correspond to major valleys and photolineaments. A newly developed technique for high-resolution reflection seismic surveying was then used. Coal seams at least 0.9 feet (0.3 m) thick and up to 1500 feet (458 m) deep were delineated, including the

Pittsburgh coal. The seismic surveying technique may possibly be useful in detecting prominent fracture zones. No faults were detected at either site. This seismic surveying technique may also be useful for monitoring burn areas during UCG tests, after proper modifications.

50958 (CONF-790630—, pp 269-273) **Field experience with Texas lignite in situ gasification tests.** Parkison, W.E. (Basic Resources Inc., Dallas, TX). May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

From experience gained during the field test at Tennessee Colony, Texas, it was concluded that: (1) the engineering problems created by water, tars, and solids have been identified. Based on the experience gained in these field tests, major revisions have been made to the basic design of the gasification process used for Texas lignite which should eliminate most of the problems encountered. (2) Liquids and solids entrained in the gas have been defined to some degree from washer/cooler samples. Further tests will be required to obtain a representative data base for water treatment. A sampling of effluent gas for solids content is also needed. (3) The generation of the majority of the water in the gasifier appears to be independent of the mode of gasifier operation if an acceptable gas is to be produced. (4) Dewatering of the lignite might improve the gas quality from this site. (5) The generation of oil/tars appears dependent upon burn intensity, volatiles in the fuel and hydrogen content in gas produced. (6) The generation of lignite fines in the surface facilities are mostly dependent upon the mode of gasifier operation.

50959 (CONF-790630—, pp 275-280) **Hydrologic and environmental findings: San Juan UCG site.** Nuttall, H.E. (Univ. of New Mexico, Albuquerque); Walters, E.A.; Niemczyk, T.M. May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

In 1978, field and laboratory studies were initiated to assess the technical feasibility of underground coal gasification in the Fruitland coal field located in northwest New Mexico. Participants in the project include University of New Mexico, Public Service Company of New Mexico, Los Alamos Scientific Laboratory, and Science Applications, Inc. A site has been selected and preliminary characterization was begun. Field activities include coring, logging, hydrologic testing and water sampling. Laboratory studies have been initiated to measure the distribution overburden, underburden and coal ion exchange constants for selected ions. The results from these activities are reported along with the laboratory analysis of water samples from both the underground coal conversion site and throughout the region. Extensive hydrologic studies of the entire region are being performed by the Bureau of Land Management and the US Geological Survey to asses the nature and availability of water in this region to aid energy development. These regional findings are discussed and their impact on underground coal conversion assessed.

50960 (CONF-790630—, pp 305-311) **Implications of RCRA, SMCRA, and TSCA on underground coal gasification.** Hagen, A.A.; Meyer, L.L.; Tipton, L.M. (TRW Energy Systems Planning Division, McLean, VA). May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

This paper presents an assessment of the implications of current legislative and regulatory actions associated with the Resource Conservation and Recovery Act (RCRA), Surface Mining Control and Reclamation Act (SMCRA), and Toxic Substances Control Act (TSCA) upon underground coal gasification. RCRA and TSCA regulations are not final; however, under the regulations as currently proposed, liquids and tars condensed from UCG product gas stream will be classified hazardous wastes, requiring application of prescribed waste disposal techniques. Options will include use of incinerators meeting specific design and performance criteria, or storage and disposal that must be documented through a manifest system for up to 20 years. TSCA premanufacture notice of chemical substances may apply unless provisions for exclusion are pursued by DOE. SMCRA regulations are now final, and coal in situ processing is to be regulated under the underground mining provisions which will include submission of detailed mining and operation permit applications, and reclamation plans, with fees based on coal production rates.

50961 (CONF-790630—, pp 313-322) **Hydrogasification of bituminous coal.** Mohtadi, M. (Aachen Univ. of Tech., Germany); Belzer, J.; Franke, F.H.; Beckervordersandforth, Chr. May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Hydrogasification has been examined by experiments with compact bituminous coal in the little autoclave plant. Isothermal gasification as well as non-isothermal gasification experiments have been executed in autoclaves. For hydrogasification of bituminous coal the constant of reaction velocity and of activation energy have been ascertained. The constant of reaction velocity was 1.5×10^{-7} (1/bar x s) at a temperature near 950°C. A model had been developed for a better judgement of underground hydrogasification. The calculated temperature- and gas profiles showed that during the penetration procedre, the zone of reaction is essentially larger than during the oxidizing gasification. The reason for this is that the constant of reaction velocity is smaller by a factor of 100 to 1000 as against to oxidizing gasification.

50962 (CONF-790630—, pp 323-330) **Reverse combustion link phenomena in bituminous coal at high pressure.** Su, F.Y.; Engleman, V.S. (Science Applications Inc., La Jolla, CA). May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Calculations were made using a combustion model to study reverse combustion link phenomena in bituminous coal at high pressure. It was found that, for a given specific rate of air injection, the reverse combustion link is achieved more rapidly at high pressure than at low pressure. At high pressure, a high partial pressure of oxygen leads to high reaction rates and therefore to steep temperature profiles. Because of this steep temperature profile, the flame front velocity is higher and peak temperature at the front is lower relative to a low pressure system. If the peak temperature is lowered sufficiently, the reverse combustion linkage process could be quenched. A parametric study has been made. Predictions of pressure, temperature, combustion front velocity, and heating value at various injection rates and permeabilities are presented.

50963 (CONF-790630—, pp 331-340) **Structural and fracture mechanics simulations associated with in situ gasification of bituminous coals.** Advani, S.H. (Ohio State Univ., Columbus); Gmeindl, F.D. May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Experimental and theoretical results from on an ongoing program on structural and fracture mechanics evaluations associated with underground coal conversion are presented. The structural mechanics simulations include subsidence, roof collapse, and cavity geometry computations with temperature dependent properties of bituminous coals and overburden shale incorporated. Corresponding fracture mechanics investigations entail characterization of the coal fracture toughness, fracture penetration in the overburden shale, and fracture permeability determination. In addition, quantitative considerations pertaining to the hydraulic fracturing of bituminous coals for initial permeability enhancement and linking are given. Finally, the applicability of the results to the planned field experiments on bituminous coals is discussed along with salient stress related differences for the simulation of moderate and thick seam sub-bituminous coal experiments.

50964 (CONF-790630—, pp 341-351) **Preliminary model for predicting water intrusion into a cavity formed during the UCG process.** Schwartz, S.H. (West Virginia Univ., Morgantown). May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

It is generally recognized that water intrusion into an underground coal gasification region significantly affects the outcome of the process. However, because of the complex nature of the water intrusion mechanisms, existing theoretical models of the UCG process have had to rely on empirical information to account for the water inflow. This study discusses some of the water influx mechanisms and in a simplified manner tries to relate them to both the 1-D and 2-D UCG modeling approaches. Comparisons are made between the different water influx mechanisms and then preliminary estimates of the total water inflow are made and compared with limited field test data.

50965 (CONF-790630—, pp 353-364) **Underground coal gasification: from research to commerce.** Graham, R.H. (Gulf Research & Development Co., Pittsburgh, PA). May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Commercialization of underground coal gasification (UCG) will occur in locations and at times where a suitable resource base, an attractive market opportunity, and an adequate technology intersect. With suitably directed programs, the first economic applications may emerge in the early nineties; thereafter, continuing developments in the market and the technology should broaden the range of applicability. Because UCG is a site-specific resource technology, its development will follow a somewhat different path from that generally visualized for surface plant technology. The development of a general technique, applicable to a wide range of resources, is apt to be an overly long and costly process. Identification of specific

targets very early in the r and d process, and an appropriate r and d program aimed at a specific target, will accelerate commercialization. A generic program conducted in parallel with site-specific projects will continue to play an essential role. Both industrial and government participants will have to learn new roles if site-specific r and d programs are to be successful. The early identification of commercial targets, essential to a site-specific program, may mislead participants and government sponsors into expecting financial participation and results which are inconsistent with the current status of UCG technology. However, if the risks and requirements are properly understood, UCG technology may be developed to play an important role in the national energy arena.

50966 (CONF-790630—, pp 365-369) **Carbon monoxide chemicals from UCG.** Haddeland, G.E. (SRI International, Menlo Park, CA). May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Carbon monoxide can readily be recovered from UCG gases by absorption in a toluene solution of cuprous chloride. The CO can then be reacted directly or converted to synthesis gas to yield chemicals such as phosgene, methanol, and acetic acid. Estimated costs for the production of acetic acid by carbonylation of methanol suggest that a sufficiently large-scale operation could be competitive if adequate markets were available at today's prices. Methanol production along would require large, new markets at higher than current values. Carbon monoxide offers a route to synthesis gas which avoids the use of oxygen. Further study is desirable to determine optimum CO yields and the practicability of cryogenic hydrogen recovery for addition to synthesis gases.

50967 (CONF-790630—, pp 371-379) **In-situ gasification research in Australia bench trials of a parallel borehole system.** Stewart, I.M. (Univ. of Newcastle, New South Wales, Australia). May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

An outline of the Australian coal resource-demand relations indicates that ultimately in-situ steam—oxygen gasification or in-situ liquid extraction of deep coal will be used. There is however a potential earlier demand for air-gasification of different or dirty seams of bituminous coal adjacent to coalfields located powerstations. For both purposes the most desirable system appears to be parallel long in-seam boreholes produced by deviated drilling from the surface. Two developments are required for this, continuous logging and control of the drill unit and a more detailed understanding of the behavior of a long in-seam blast inlet. Initial experiments with a 200 mm. thick bed of packed fine coal illustrate the characteristics of cyclic flow reversal between parallel boreholes and clearly show the advantages of this system in stabilizing a high combustion zone temperature. Such a bed can become a useful tool to study system behavior.

50968 (CONF-790630—, pp 401-402) **Studies of in situ combustion in a surface trench facility.** Chaiken, R.F.; Singer, J.M.; Lee, C.K. (US Dept. of the Internor, Pittsburgh, PA). May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Preparations have been completed for a second in situ coal combustion experiment in the Bureau of Mines' sealed-trench burn facility at Bruceton, Pa. It is expected that experimental results will be available for oral presentation. The objectives and experimental design are discussed.

50969 (CONF-790630—, pp 437-449) **Review of supporting research at Oak Ridge National Laboratory for underground coal conversion.** Westmoreland, P.R.; Dickerson, L.S. (Oak Ridge National Lab., TN). May 1979.
From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Chemical and physical properties of lignite, subbituminous coal, bituminous coal, and overburden have been measured in research that began in 1974 at Oak Ridge National Laboratory. Generally, large, monolithic blocks of sample have been dried and pyrolyzed. Thermal data and product yields can be correlated to provide an extrapolation from powder pyrolysis to the pyrolysis steps in underground coal gasification. Significant results of the past year include correlation of block pyrolysis data for low-rank coals, interpretation of mechanisms, and comparison between low-rank and bituminous coals; heating tests of overburden cores from the Hoe Creek field gasification site; and measurement of physical properties, particularly thermal diffusivity and thermal conductivity of low-rank coals. Correlations, mechanisms, and property measurements are reviewed, and applications to underground coal gasification are discussed.

50970 (CONF-7606131—, pp 131-140) **Potential of in situ gasification for Texas lignite.** Edgar, T.F. (Univ. of Texas, Austin). 1978.
From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

A brief history of Russian and US work in underground gasification of coal along with a status report on current field-testing programs is given in this paper. The application of underground gasification to Texas lignite is discussed in detail; applicable resources and their chemical and physical properties pertaining to this process are delineated. The recovery of deep-basin Texas lignite by in situ gasification does appear to be both technically and economically feasible; data supporting these conclusions are presented. Engineering aspects of the Russian system for in situ gasification, which is suitable for use in Texas, are discussed.

50971 (CONF-7606131—, pp 141-152) **Lignite and the Koppers-Totzek process.** McGurl, G.V.; Farnsworth, J.F. (Koppers Co., Inc., Pittsburgh, PA). 1978.
From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

The Koppers—Totzek coal-gasification process is described. Process conditions, including raw material and utility usages, overall material and energy balances, and efficiency are given for a Koppers—Totzek plan producing intermediate-Btu gas from Texas lignite. The environmental concerns and economics of the process are discussed.

50972 (CONF-7606131—, pp 153-159) **Lignite gasification using the CO_2 acceptor process.** Curran, G. (Conoco Coal Development Co., Library, PA). 1978.
From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

The CO_2 acceptor process is in the final stage of development in a pilot plant in Rapid City, South Dakota. The gasifier product gas, without methanation, can serve the needs of the Gulf Coast area for clean fuel gas and for chemical feedstock using Texas lignite. The following are typical characteristics of the K—T process. (1) Simple construction. (2) Accepts a wide variety of feedstocks. (3) Economically competitive with other commercially available processes. (4) Environmentally clean. (5) Provides easy retrofitting on gas- and oil-fired systems. (6) High unit capacity. (7) Safe. The K—T process produces a readily usable intermediate-Btu fuel gas in an environmentally acceptable manner. The costs are competitive with other existing conversion processes.

50973 (CONF-7606131—, pp 179-184) **Lignite as a source of chemical feedstocks.** Scarrah, W.P. (Univ. of North Dakota, Grand Forks); Calkins, W.H. 1978.
From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

Natural gas, natural gas liquids, and crude petroleum are the predominant raw materials for the United States petrochemicals industry. However, only a small percentage of the total production of these materials is used for chemical feedstocks. Most of it is consumed as fuel to produce energy. As coal comprises 87 percent of our fuel reserves compared to only 4 percent for petroleum and natural gas, it seems inevitable that coal must be utilized more extensively for both energy and chemicals production. Due to its accessibility and favorable chemical reactivity, lignite is feasible for conversion to more convenient fuels and chemicals. Three lignite-based sources of chemical feedstocks are lignite, improved fuels, and byproducts from improved fuels. Some feedstocks can be directly separated from the sources, but most will be obtained via additional chemical processing. Because of its structure, coal is primarily attractive as a source of aromatic compounds. However, by converting it into synthesis gas (carbon monoxide and hydrogen) it can be used to synthesize paraffins and olefins. Most existing coal technology is oriented toward breaking coal into smaller components and adding hydrogen to produce improved fuels. More emphasis on the utilization of lignite as a source of chemical feedstocks might result in less complex processes than used to produce fuels.

50974 (DOE/ET—0069/1) **Coal demonstration plants. Quarterly report, January—March 1978.** (Department of Energy, Washington, DC (USA). Div. of Coal Conversion). Sep 1978. Contract EX-76-C-01-2297. 58p. P 04/MF A01.
The Department of Energy's demonstration plant program was started in 1974 by one of the Department of Energy's predecessor agencies, the Office of Coal Research, US Department of the Interior. The objective of the program is to establish the technical and financial feasibility of coal conversion technologies proven during pilot plant testing. Demonstration plants will minimize the technical and economic risks of commercialization by providing a near commercial size plant for testing and production. Thus, DOE is sponsoring the development of a series of demonstration plants, each

of which will be a smaller version of commercial plants envisioned for the 1980's. These plants will be wholly integrated, self-sufficient in terms of heat generation, and dependent only on feedstock of coal, water, and air. Under the DOE program, contracts for designing, constructing, and operating the demonstration plants will be awarded through competitive procedures and will be jointly funded. The conceptual design phase will be funded by the government, with the detailed design, procurement, construction, and operation phases being co-funded, 50% from industry and 50% from the government. The cost involved in building and operating a demonstration plant will probably be between $200 million and $500 million, depending on the size of the plant. Seventeen projects in this program are discussed briefly with identification of the company involved, funding, flow sheets, history and progress during the quarter. (LTN)

50975 (FE—1207-57) **Gas generator research and development: BI-GAS process. Quarterly report, October—December 1978.** (Bituminous Coal Research, Inc., Monroeville, PA (USA); Phillips Petroleum Co., Homer City, PA (USA)). Feb 1979. Contract EX-76-C-01-1207. 52p. P 04/MF A01.

Catalysts BCR Lots No. 4120, 4121, and 4122 were subjected to an additional life test to determine more precisely the behavior of the catalysts within the temperature range of 800 to 1000°F. On the basis of the overall results obtained, a PEDU-scale catalyst sample, based on No. 4122, was ordered from the supplier. Further bench-scale testing indicated that it should be possible to activate these catalysts adequately with a hydrogen-rich synthesis gas containing about 6% carbon monoxide (hydrogen/carbon monoxide ratio, approximately 12/1). Initial catalyst activities with this procedure were quite similar to those obtained in an earlier test when the samples were activated using pure hydrogen. On the other hand, catalyst activities did not increase significantly during the test, indicating that higher temperatures (above 950°F) might be required in a PEDU test to achieve optimum catalyst activity. A life test of catalysts BCR Lots No. 4104, 4105, 4106, and 4107 was initiated to determine the effect on their thermal stability of adding various promoter metals to these nickel—molybdenum catalysts. Preliminary results indicate that the promoters were ineffective in enhancing thermal stability. PEDU Test No. 32 was conducted over the 5-day period of November 6 to 10, 1978. The catalyst used, a noble metal-promoted nickel catalyst, was the most active of any tested to date. It also showed greater methanation selectivity tha the BI-GAS pilot plant methanation catalyst. The data show that with this catalyst it was possible to obtain a product gas meeting pipeline quality specifications in a single pass through the fluidized bed methanator, without the need for polishing methanation (and without the need for secondary carbon dioxide removal).

50976 (FE—1784-45) **Program to discover materials suitable for service under hostile conditions obtaining in equipment for the gasification of coal and other solid fuels. Quarterly progress report, July 1—September 30, 1978.** Schaefer, A.O. (ed.). (Metal Properties Council, Inc., New York (USA)). 3 Jan 1979. Contract EX-76-C-01-1784. 220p. P 10/MF A01.

Sixty-one alloys have been approved for testing in phase 1 involving high temperature corrosion experiments and specimen exposures in coal gasification pilot plants and some aqueous corrosion testing. Erosion—corrosion testing is also reported. Detailed results of stress-rupture tests at various temperatures on 16 alloys are given. (LTN)

50977 (FE—2218-25) **Improvement of the mechanical reliability of monolithic refractory linings for coal gasification process vessels. Quarterly progress report, July 1978—September 1978.** (Babcock and Wilcox Co., Lynchburg, VA (USA). Materials and Chemical Technology Lab.). 1978. Contract EX-76-C-01-2218. 73p. P 04/MF A01.

The additional progress made on the mathematical model and the acoustic emission and strain gage measuring techniques is described and discussed. The post testing and heat-up test results on Lining # 5, a dual component monolithic lining run to 1850F in 150 psi steam are also decribed and discussed. Further proof of improved lining performance is presented. It has been achieved through the use of a 50% Al_2O_3 refractorty concrete in the dense component instead of a 90% Al_2O_3 refractory concrete. This material has a low shrinkage and good creep resistance. Some evidence is presented that suggests the steam exposure may have enhanced the strength of the 50% Al_2O_3 refractory concrete.

50978 (FE—2247-20) **Gasification of residual materials from coal liquefaction. Type III Extended Pilot Plant Evaluation of SRC-II vacuum flash drum bottoms from Kentucky No. 9/14 coal.** Robin, A.M. (Texaco, Inc., Montebello, CA (USA). Montebello Research Lab.). Feb 1979. Contract EX-76-C-01-2247. 70p. P 04/MF A01.

A Type III Extended Pilot Plant Evaluation of SRC-II vacuum flash drum bottoms obtained from the liquefaction of Kentucky No. 9/14 coal at Ft. Lewis, Washington was successfully completed at Texaco's Montebello Research Laboratory. A total of 31 tons of the SRC-II residue was gasified during eight pilot plant runs at 350 psig. Operating conditions were varied to determine the optimum. The dry syngas produced contained over 90 (vol) percent hydrogen plus carbon monoxide. No major operating problems were experienced and all of the key phases of the gasification were demonstrated. An estimate of operation for a commercial sized gasifier was prepared.

50979 (FE—2274-T1) **Entrained-bed coal gasification modelling. Interim report.** Wen, C.Y.; Chuang, T.Z. (West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering). 1978. Contract EX-76-C-01-2274. 126p. P 07/MF A01.

A mathematical model has been developed to simulate the Texaco Downflow Entrained-Bed Pilot Plant Gasifier using coal liquefaction residues and coal-water slurries as feedstocks. The entrained-bed gasifier was conceptually divided into three zones: the Pyrolysis and Volatile Combustion Zone, the Gasification and Combustion Zone, and the Gasification Zone. The gas phase was assumed to be completely mixed at the entrance region followed by a region approximating plug flow. The solid phase was assumed to be a plug flow throughout the reactor. Temperature and concentration profiles along the reactor were obtained by solving the material and energy balances and taking into consideration the gasification kinetics, the transport rates and the hydrodynamics of the gasifier. The results of computation from the proposed model were compared with the experimental data. Sensitivity of the parameters used in the model was tested and optimum operating conditions were searched to provide a better understanding of the performance under various operating conditions utilizing the model.

50980 (FE—2434-33) **Pipeline gas from coal—hydrogenation (IGT hydrogasification process). Project 9000 quarterly report No. 8 for the period April 1—June 30, 1978.** (Institute of Gas Technology, Chicago, IL (USA)). Mar 1979. Contract EX-76-C-01-2434. 98p. P 05/MF A01.

Illinois bituminous coal was used to acquire data for optimizing the HYGAS Process. Three major modifications were made in the pilot plant to encourage optimum operating conditions and clinker-free operation. Their effectiveness was assessed by Test 71, which successfully showed that all three modifications effectively left the steam—oxygen zone entirely clinker-free after the test. A post-run inspection and the necessary turnaround activities were completed after Test 71. Test 72 was conducted as a continued exploration of the conditions for optimizing reactor operation by improving carbon conversion to the 85% to 90% level, increasing the temperature in the steam—oxygen gasifier to 1800°F, and continuing to reduce the steam-to-char ratios to approximately those used in the commercially designed (by Procon, Inc.) HYGAS Process unit. During Test 72, a total of 392 tons of pretreated char was fed to the reactor. Char conversions, determined by quick ash analyses, ranged from 60% to 90% at an operating temperature of 1800°F. The steam feed rate was set at 5000 lb/hr, and the char feed rate was 2 tons/hr. The test was terminated at the end of the month when the vibrating feeder from the pretreated-char storage hopper failed and forced the suspension of char feed to the reactor. Several steady-state periods were selected for detailed study. A post-run inspection of the plant was made to determine the areas where modifications might be made to further increase the operating efficiency of the pilot plant. As a result, the bucket elevator speed was increased to improve its capacity, and the coal-mill crushing speed was lessened to reduce fines generation.

50981 (FE—2496-29) **Characterization of hydrogen cyanide production in coal gasification.** Nakles, D.V. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Environmental Studies Inst.). Jul 1979. Contract EX-76-S-01-2496. 62p. P 04/MF A01.

In the past, the characterization of hydrogen cyanide production has been accomplished by the examination of the raw product gas quench condensate. Based on these examinations, a normalized hydrogen cyanide production in the range of $3(10^{-6})$ to $4(10^{-2})$ pounds per ton of moisture-and-ash-free (MAF) coal has been determined. These production rates imply that the processing and treatment problems associated with hydrogen cyanide may be minimal in coal gasification. However, the previous quench condensate characterization efforts were inadequate due to: The lack of verified sampling methods; the lack of verified preservation and analytical techniques; and the inefficiency of the quench operation in removing cyanide from the raw product gas. Improved characterization techniques have focused on the characterization of both the liquid and gas phase quench effluents as well as the raw product gas prior to the quench operation. In particular, the quench condensates have been characterized using preservation and analytical techniques tailored to address the idiosyncrasies of the gasification wastewaters. These techniques were developed and verified on a variety of synthetic and pilot plant process samples. The quenched product gas was examined using a specially designed on-line sample train. The combined results of these efforts were used to determine the efficiency of cyanide removal in the various quench operations and provide an estimate of total hydrogen cyanide production. Based on these efforts, hydrogen cyanide production in coal gasification has been assessed to be in the range of 0.01 to 1.3 pounds per ton of MAF

coal. These data are significantly higher than previous results and indicate that cyanide production may be significant and should not be considered negligible when considering various liquid and gas phase effluent treatment. (LTN)

50982 (FE—2561-3) **Conversion of Rapid City Pilot Plant, Phase II. Heat and mass balance calculating program for pressurized fluidized bed gasification process; WEGAS User's Manual.** Somers, E.V.; Vidt, E.J.; Weeks, K.D. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). Dec 1978. Contract EF-77-C-01-2561. 43p. P 03/MF A01.

The pressurized fluidized bed coal gasification process has been modeled by a steady-state mass and energy balance program, WEGAS. Two alternative cold-gas desulfurization processes, Benfield and Selexol, have been integrated with the gasification model and are available for use in analyzing both the gasification model and integrated low Btu gas-fired combined cycle power plant. This report contains the User's Manual needed to use the program and a sample problem is presented to illustrate the input/output formats.

50983 (FE—2635-T1) **Conceptual designs for water treatment in demonstration plants. I. Plant designs.** Seufert, F.B.; Hicks, R.E.; Wei, I.W.; Goldstein, D.J. (Water Purification Associates, Cambridge, MA (USA)). Mar 1979. Contract EF-77-C-01-2635. 487p. P 21/MF A01.

We have concluded that: (1) It is worhtwhile considering procedures for production of boiler feed water which, while well established, are not always considered. We recommend consideration of counter-current regenerated ion exchange, particularly when a concentrated waste stream is preferred to a higher volume dilute waste; we recommend also consideration of reverse osmosis, particularly when a dilute waste stream with minimum total salt content is preferred. (2) Designing treatments for wastewater is limited by lack of information. Some needs are listed under recommendations. (3) The cost of treating highly concentrated, organically contaminated wastewater can be significantly reduced by using two different treatments in sequence rather than relying on one treatment only. (4) It has proved to design for a high degree of water reuse with minimum water discharge. This entailed high concentrations in circulating cooling waters which, while most probably attainable, should be demonstrated to be practical. (5) The approximate cost for water management is in the range of 10 cents/10^6 Btu for Hygas demonstration plants (east and west); 5 cents/10^6 Btu for commercial Lurgi plant; 1.1 cents/10^6 Btu for the SRC plant which has very small water streams; 15 cents/10^6 Btu for the Bigas plant using sewage (one third of the cost is to fit treated sewage for boiler feed); 19 cents/10^6 Btu for the Synthane plant with brackish water intake (the reverse osmosis units are expensive).

50984 (FE—2785-T1) **Design, engineering, and evaluation of refractory liner for slagging gasifier. Second quarterly technical progress report.** Firestone, R.F.; Greaves, M.J.; Hales, C. (IIT Research Inst., Chicago, IL (USA)). Apr 1979. Contract ET-78-C-01-2785. 88p. P 05/MF A01.

The design of a refractory lining system for a slagging coal gasifier should take into account: oxidation or reduction of the refractory materials subject to the process atmosphere at the operating temperature; and the corrosive action of the slag at the operating temperature. The initial cost of the refractory lining system for a slagging coal gasifier may represent from ten to twenty-five percent of the cost of the reactor. The total cost of the refractory lining system for a slagging coal gasifier, including the total cost of all subsequent relines, may represent more than fifty percent of the total cost of the reactor. The final choice of a lining system should be based on an economic analysis which reflects the total cost of the lining system over the life of the coal gasifier. The findings of this study are preliminary in nature and are subject to change, following completion of Phases B through F of this program.

50985 (FE—2806-2) **Coal gasification pilot plant support studies. Project 61015 (formerly 9030) quarterly report, July 1—September 30, 1978.** Tran, D.Q.; Nandi, S.P.; Singh, S.P.; Knowlton, T.M.; Weil, S.A.; Lee, A.L.; Anderson, G.L.; Onischak, M.; Knight, R.A.; Babu, S.P. (Institute of Gas Technology, Chicago, IL (USA)). Dec 1978. Contract ET-78-C-01-2806. 104p. P 06/MF A01.

Various studies carried out in support of coal gasification are reported (kinetics, effect of mineral matter, efficiency, fluidized bed studies, coal preparation, treatments to reduce agglomeration, product and waste gas processing, etc.). (LTN)

50986 (FE—3023-4) **Inactivation/property management of the agglomerating burner PDU. Third quarterly technical progress report, 1 February—30 April 1979.** Litt, R.D. (Battelle Columbus Labs., OH (USA)). May 1979. Contract ET-78-C-01-3023. 4p. P 02/MF A01.

The PDU has been maintained in accordance with the detailed Maintenance Procedures. This maintenance includes all of the equipment of the PDU plus the property management and security of the facility.

50987 (FE—3253-T1) **Role of C—CO_2 in gasification of coal and char. Annual report, August 16—December 31, 1978.** Wen, C.Y.; Sears, J.T. (West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering). 1978. Contract ET-78-S-01-3253. 12p. P 02/MF A01.

Reactivity of chars obtained by physical mixing of coal with catalyst additives followed by pyrolysis shows increased reactivity with K_2CO_3 additive, but not with CaO. The E/sub act/ for CO_2 reaction with char-additive K_2CO_3 is 20,000 cal/mole in the temperature range 600 to 800°C, and reactivity has increased 5 to 10 times. Caution should be used in interpretation of these results because of complications from particle size effects and from variations in char oxygen with pyrolysis temperature. The LED-light probe for bubble detection in fluidized beds has been shown to work effectively. However, non-uniform gas distribution and non-vertical bubble rise make the use of the probe complicated. Future work will center on char reactivity, pore and surface area development with conversion, and measurement of effective diffusivities.

50988 (LBL—8069) **Diffusion of a chemical species through a viscous boundary layer.** Keller, J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1978. Contract W-7405-ENG-48. 31p. P 03/MF A01.

The energy and species equation can be made to reduce to the same form under suitable assumptions. This result is discussed and used to determine the concentration difference of H_2S in a highly corrosive coal gasification mixture. It is shown that the reaction rate is kinetically controlled and not diffusion limited. The possibility of using boundary layer control to prevent corrosion of the container walls is also investigated. It is shown that with a suitable injection gas the concentration of H_2S at the surface can be reduced to a low enough level to stop the corrosion process.

50989 (METC—8085-T1) **Department of Energy/Morgantown Energy Technology Center 42-inch diameter producer stream gas clean-up system mathematical model.** (TRW, Inc., McLean, VA (USA). Energy Systems Planning Div.). Mar 1979. Contract EY-77-C-21-8085. 134p. P 07/MF A01.

This report presents the mathematical models and computational procedure for the material balance calculation around each of the following units that constitute the METC producer gas clean-up system: gas cyclone; humidifier; electrostatic precipitator; hydrolysis unit; direct cooler; Stretford process; and final wash tower. The computation procedure is specifically designed to calculate the material balance for the producer gas clean-up system. All items to be computed by the program are listed. The process is sequential, in that the outlet stream from a unit is directly fed into the unit immediately following it. This procedure simplifies the computation because no iteration procedure is required. Two different kinds of data input are needed in each process unit calculation: preassigned data, such as temperature and pressure etc., and feed composition and flow rate. The gasifier simulation program developed earlier is integrated with this gas clean-up system simulation program through a hypothetical joint box. The present clean-up system modelling is handicapped by a lack of some crucial information, among them being: vapor—liquid equilibrium and enthalpy data for tar; proprietary process equipment performance information; and reaction kinetics information. Wherever such information is lacking, appropriate assumptions are made to circumvent the difficulty. These assumptions, however, should be verified by comparing computed values from this program with experimentally obtained data from the pilot plant.

50990 (METC/RI—79/6) **METC SOA test valve No. A-6: 6-inch Rockwell Nordstrom plug valve.** Gardner, J.F. (Department of Energy, Morgantown, WV (USA). Morgantown Energy Technology Center). May 1979. 85p. P 05/MF A01.

This report documents the results of ambient temperature static tests on a 6-inch Rockwell Nordstrom lubricated plug valve, ANSI Class 250, Rockwell Nordstrom Figure 265 (NETC SOA Test Valve A-6). The valve body and plug are of cast iron construction, with TFE coating of the plug surface. The objectives of the test were to determine baseline leakage rate and valve response time data. The test valve was cycled a total of 479 times during seven different runs. Run 07 was performed to establish baseline data for the new, factory-assembled valve. A total of 90 leak tests were performed during this run, while the total number of valve closure cycles at the end of this test period was 261. Leakage values remained within specification limits (6 scfm). Evidence of pressure being trapped in the plug was noted. Test Runs 07B through 07E were all performed in attempts to repeat the baseline leak rates results for Test Runs 07 and 07A after valve disassembly, inspection, and reassembly. This goal was not achieved as documented in the Procedure and Results section. Test Run 07F was performed after the valve plug and seat had been lapped to achieve metal to metal contact which is a different configuration than for prior tests which used plastic coating on the plug; both configurations used a lubricant seal, but different lubricants were used for each configuration. This arrangement yielded leak rate results which were 200% to 600%

lower than the results of Test Runs 07 and 07A. However, intermittent leakage of unknown magnitude occurred which required maintenance of the valve including the addition of lubricant and increasing the load between plug and seat by tightening the packing gland.

50991 (TID—29302) **Coal processing for fuel cell application. Task III: fluidized bed gasifier model. Task report, July 1—October 31, 1978.** Finson, M.L. (Physical Sciences, Inc., Woburn, MA (USA)). Nov 1978. Contract EW-78-A-21-8450. 37p. P 03/MF A01.

We have outlined the essential elements of a computational model for fluidized bed gasification of coal. Many aspects are similar to existing models for catalytic reactors, although such features as the treatment of the coal particle inventory are apparently new. The proposed method of predicting the bubble size should also prove to be an improvement over existing empirical approaches. Of course, many details will have to be filled in during the actual construction of the computer program. An important aspect of developing the computer program will be the selection of an appropriate set of experimental results, against which to verify the model. It must be recognized that there are few detailed measurements of properties within a fluidized bed, simply because the fluidizing particles preclude the use of most fluid dianogistic techniques. More often, data will be limited to gas conversions and (with reacting coal particles) overall coal throughput rates. Catalytic reactors obviously represent a limited situation, but sufficiently high quality data would enable a good check on the aspects of the model dealing with gas mixing and conservation. The laboratory scale experiments with coal are of more interest, particularly those where pyrolysis does not account for all of the conversion. There may also be useful fluidized bed combustion data, although FB combustors often operate in the teeter bed regime. Finally, of course, it will be most desirable to obtain a decent set of performance data for one or more pilot plant fluidied bed gasifiers.

50992 (UCRL—52572) **Underground coal gasification station at Lisichansk.** Olness, D.U. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 19 Sep 1978. Contract W-7405-ENG-48. 59p. P 04/MF A01.

This report continues our survey of the Soviet effort in underground coal gasification and summarizes the research conducted at Lisichansk from 1948 to 1963. This facility was operated primarily as an experimental-industrial station, and techniques for in situ coal gasification were developed and improved during this period. The stream method of gasification, which required mined shafts, was investigated first. By the late 1950's, improvements in methods and equipment enabled the Soviets to recover coal reserves at Lisichansk efficiently without using underground labor to create the necessary channels. This report discusses the geological, hydrological, chemical, technological, and economic factors affecting the construction, process optimization, operation, and maintenance of in situ gas generators. The available data for individual generators operated at Lisichansk during this period are also presented.

50993 **Dry piston coal feeder.** Hathaway, T.J.; Bell, H.S. Jr. (to Dept. of Energy). US Patent 4,140,228. 20 Feb 1979. Filed date 1 Dec 1977. 6p.

PAT-APPL-856,368.

This invention provides a solids feeder for feeding dry coal to a pressurized gasifier at elevated temperatures substantially without losing gas from the gasifier by providing a lock having a double-acting piston that feeds the coals into the gasifier, traps the gas from escaping, and expels the trapped gas back into the gasifier.

50994 **Coal gasification in Europe.** Seelemann, D. (Centre d'Etudes et Reccherches des Charbonnages de France, Verneuil-en-Halatte). pp 388-396 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Several European countries have been pioneers in coal gasification, both for surface gasification from coal mined underground and for in-situ gasification. Underground gasification experiments were conducted initially by the Soviet Union and France; then by Great Britain, about 30 years ago. This paper discusses the trends of research for the last 10 years, the results obtained, and the future prospects. 3 figures, 3 tables.

50995 **Trace element distributions in coal gasification products.** Koppenaal, D.W. (Dept. of Energy, Pittsburgh, PA); Schultz, H.; Lett, R.G.; Brown, F.R.; Booher, H.B.; Hattman, E.A.; Manahan, S.E. *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **24**: No. 1, 299-306(1979). (CONF-790415—P2).

From 177. national meeting of the American Chemical Society; Honolulu, HI, USA (1 Apr 1979).

The determination of the fate and distribution of trace elements during coal conversion is an important and prerequisite task if such an industry is to be implemented on a massive scale. Considering the overwhelming abundance of native coal resources, an implementation of this magnitude is a distinct possibility in the near future. In conjunction with ongoing coal gasification studies at this laboratory, trace element investigations have been performed to help assess potential environmental impacts of coal gasification processes. This work presents preliminary findings of trace and minor element distributions in the process streams of the SYNTHANE Gasifier Process Development Unit. All process streams were surveyed for approximately 65 elements by conventional SSMS analyses. Such analyses provide quick multi-element analyses that are valuable when inorganic composition of the process streams are unknown and/or unsuspected. This type of analysis is especially useful for process monitoring applications, resulting in an almost complete inorganic characterization of process streams from such a conversion unit. This kind of characterization is especially useful in delineating potential problems and pointing out the need for more accurate analyses of specific elements. Both the SSMS survey results and the more accurate, precise results obtained by ID-SSMS and AAS show the gasifier char to be the major elemental sink for most elements. This has important environmental ramifications in that this material may be utilized as combustion material for production of process steam. The fate of environmentally important elements during this combustion will need to be determined. On the other hand, if the char is disposed of as an alternative to its by-product utilization, significant solid waste problems will almost certainly occur. Mass balances of elements across a conversion unit may be valuable in predicting te release rates of certain elements to the environment.

50996 **Materials problems and opportunities in coal conversion systems.** Stringer, J. (Electric Power Research Inst., Palo Alto, CA). *SAMPE Q.;* **10**: No. 1, 45-53(Oct 1978).

From 5. energy technology conference; Washington, DC (Feb 1978).

In many of the advanced coal conversion systems now being developed, the materials of construction will be exposed to very severe conditions. It is probable that the ability of materials to withstand these conditions will ultimately determine the success or failure of the new technologies. A number of specific examples are discussed, and four systems are analyzed in more detail: heat exchangers in fluidized bed combustors, gas turbines in combined cycle systems, low-pressure steam turbines, and superheaters in pulverized coal boilers. In each of these cases the problem is in part the deterioration of materials in contact with the environment, but the solution to the problem requires the close integration of materials development and design engineering.

50997 **Data acquisition and process control instrumentation for in-situ coal gasification.** Moore, D.F.; King, S.B.; Lanum, W.J.; Smith, J. (US DOE, Laramie Energy Technol Cent, Wyo). *Instrum. Min. Metall. Ind.;* **6**: 59-70(1978).

A computer-based instrumentation system is described which provides a very effective means of monitoring and controlling an in-situ coal gasification installation. The benefits of such a system have been proven by several in-situ coal gasification field experiments. Past and present process data such as flow rates, pressures, temperatures, and gas composition are immediately available. Computer automatic control maintains air injection rates with great precision and can be used to change automatically air injection rates in response to changes in other process parameters. In addition, many routine duties are no longer required to be performed by the operators. 10 refs.

50998 **In-situ processing of coal for SNG.** Davis, B.E. (Gulf Research and Development Co., Pittsburgh, PA). pp 472 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Production of synthesis gas by underground coal gasification offers an alternate route for conversion of coal to SNG. The primary problem in synthesis gas production is the lack of field experience for oxygen injection. Existing field tests of the UCG process deal with air injection for production of low heating value gas. The previous field tests and the existing DOE program at Hanna and Hoe Creek, Wyoming, offer convincing evidence that the basic UCG process is viable. There is limited field experience in the utilization of enriched air or oxygen in UCG. A conceptual design of a plant for production of SNG from coal via in situ processing has been developed and preliminary economics suggest that production of SNG for $2.90/1,000 scf. (MCW)

50999 **Low- and medium-Btu commercialization: DOE perspective.** Myerson, E.J. pp 756-759 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Comments are made on the government's role in the commercial development of low and medium Btu coal gasification technologies. The government is aware of the commercialization constraints

faced by these processes. Changing state and Federal policies with regard to balancing environmental considerations against energy needs continues to confuse consumers to use coal in lieu of natural gas and oil. This policy confusion is particularly evident in two DOE coal conversion projects: the H-coal liquefaction project and the low Btu combined cycle project at Pekin, Illinois. These projects have been temporarily halted by the environmental department of their respective states. There are only three environmentally acceptable on-site methods of substituting coal for oil and gas in the industrial sector. These methods are conventional burning of coal with a scrubber (conventional direct combustion), combustion of coal in an atmosphere fluidized bed (AFB), and low and medium Btu coal gasification or LBG/MBG. After comparing the economics of the system and discussing LBG/MBG and the National Energy Plan, market potential and constraints, and government policy, the author concludes that if he were faced with an investment decision, he would consider LBG/MBG. The agency expects LBG/MBG to penetrate its natural market with the passage of NEP. The focus of the DOE low and medium Btu gas commercialization policy will be in technology transfer and to pursue and provide initiative which will accelerate market penetration. (MCW)

LIQUEFACTION

REFER ALSO TO CITATION(S) 50935, 50974, 50978, 50983, 50996, 51041, 51982

51000 (CONF-7606131—, pp 160-169) **New liquid fuels from coal: progress in the ERDA program.** Mills, G.A. (Energy Research and Development Administration, Washington, DC). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

A comprehensive research, development, and demonstration program for production of clean liquid fuels from coal and lignite is progressing rapidly with present annual funding of more than $100 million. The coal-liquefaction program has entered a new phase with the operation of several large pilot plants and plans for construction of a demonstration plant. Cost estimates for coal-derived liquids from these processes are high and they require great capital investment. Consequently, an active research program has been initiated seeking more efficient and less costly processes which can be the basis of third-generation plants. One novel coal-liquefaction process is flash hydropyrolysis. A second special opportunity, one for which much of the technology has been established, involves the reaction sequence: coal or lignite CO + He_2 → CH_3OH → high-octane gasoline. The technology for manufacture of methanol from coal is available today. Furthermore, using a remarkable new catalytic process, Mobil Research and Development has found that methanol can be converted to high-octane gasoline in high yields. The aromatic character of this gasoline distinguishes it from the Fischer-Tropsch product and illustrates the effectiveness of the concept of using catalysts to achieve molecular-engineering advances. Other promising new processes are discussed briefly.

51001 (CONF-7606131—, pp 170-178) **Potential for lignite liquefaction.** Souby, A.M. (Univ. of North Dakota, Grand Forks). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

The ultimate goal is the design of a pilot plant for an integrated lignite refinery producing liquid, solid, and gaseous fuels and chemical feed stocks, utilizing novel techniques developed by the project coupled with current technology for coal and hydrocarbon processing. Major emphasis at present is being given to the operation of a process development unit (PDU) for solution hydrogenation of lignite to produce solvent-refined lignite (SRL). The PDU incorporates a solid—liquid separation (SLS) system based on the enhanced solubility of coal liquids in a light solvent at elevated pressure and near the critical temperature of the solvent. In the liquefaction section of the PDU, 88-percent conversion and 63-percent yields of SRL and lighter oils based on mineral-ash-free coal have been achieved. A unit is under construction for the hydrogenation of SRL, since it appears that the best approach to the production of light fuel products or of synthetic crude oil would be a two-stage process. The SRL free of ash and low in sulfur would be produced in the first stage in a noncatalytic reaction with minimum hydrogen consumption, and this SRL would then be catalytically hydrogenated in the second stage. In small-scale-batch autoclave experiments, SRL has been converted to the extent of 90 percent to lighter liquid products with about 40 percent of the products being in the gasoline boiling range. A number of processes for coal liquefaction have been studied and publicized. In addition, proprietary processes about which less is generally known are under development. Large pilot or demonstration plants are proposed or planned.

51002 (DOE/ET—0068/1) **Coal liquefaction. Quarterly report, January—March 1978.** (Department of Energy, Washington, DC (USA). Div. of Coal Conversion). Sep 1978. Contract EX-76-C-01-2297. 60p. P 04/MF A01.

The advantage of coal liquefaction is that the entire range of liquid products, including heavy boiler fuel, distillate fuel oil, gasoline, jet fuel, and diesel oil, can be produced from coal by varying the type of process and operating conditions used in the process. Furthermore, coal-derived liquids have the potential for use as chemical feedstocks. To provide efficient and practical means of utilizing coal resources, DOE is sponsoring the development of several conversion processes currently in the pilot plant stage. Fifteen coal liquefaction projects supported by US DOE are described briefly, with flowsheets, funding, history and progress during the quarter. (LTN)

51003 (DOE/EV—0044) **Environmental analysis of synthetic liquid fuels.** (Department of Energy, Washington, DC (USA)). 12 Jul 1979. 144p. P 07/MF A01.

Assuming application of the most effective environmental control technolgies and practices, deployment of synthetic liquids facilities on an accelerated schedule to 1990 appears feasible in terms of current environmental constraints. Yet-to-be-defined regulations, in their stringent forms, could change this finding. These regulations include visibility, short-term nitrogen oxide ambient standard, extension of prevention of significant deterioration (PSD) regulations, hazardous waste standards, toxic product regulations, and occupational safety standards. Any production level requires resolution of a number of institutional constraints, including permitting delays and the acceptability of the facility to the local population and state authorities. The greatest impediments for the first-generation technologies include long time delays, facility size limitations, and unwillingness to change the character of the community. There appears to be no absolute environmentally related constraint identified for any of the first-generation surface conversion technologies; second-generation processes run greater risks of major environmental problems. For in situ processes, the major risk is leaching of hazardous materials into water; for direct liquefaction, concern is potential worker and public exposure to toxic substances. Yet-to-be-defined regulations are perceived by developers as major technology development impediments. These include air quality standards (visibility, short-term nitrogen oxide and new PSD regulations), regulation of hazardous wastes and toxic products, underground injection guidelines, and worker safety regulations. Some risk exists that environmental R and D programs cannot fully satisfy all existing and expected regulatory demands, but these risks should be known by 1985 and it is expected that appropriate control adjustments can be made. (LTN)

51004 (FE—1517-71) **Coal liquefaction test center. Quarterly technical progress report, April—June 1978.** (Fluor Engineers and Constructors, Inc., Irvine, CA (USA)). Mar 1979. Contract EX-76-C-01-1517. 140p. P 07/MF A01.

The primary accomplishment of this quarter was the successful completion of Runs 008, 009, and 010. Summary data for these runs is shown in Table I. Run 008 extended for 130 hours on solvent/Dox oil, 15 hours on stored extract, and 6 hours on fresh extract (integrated operation). Run 009 involved Section 600 only, and ran from May 24 through June 1, with the section operating for 67 hours on solvent/Dox oil. Run 010 began on June 21, and for a 109-hour period, Section 600 - Hydrogeneration - was in stable operation on a recycle extract feed stock. The section was brought to stable operation on a 50% Dox oil—50% topped solvent feed. The D-A601D reactor had a catalyst charge, while the DA601A was used as a feed preheater and stabilizer for the feed stock. The concentration of extract in the feed was increased from 21% to 45% while reaction temperatures increased by 35°F, from 745 to 780°F. Desulfurization as high as 80% was experienced. Disappearance of extract (defined as process material boiling at 825°F or higher) was about 27%. Over 7,000 gallons of heavy fuel oil was produced with average sulfur and ash contents of 0.3 and 0.13%, respectively. Run 010, which was terminated to permit work on an external natural gas supply line, demonstrated that stable operation can be achieved and maintained for a prolonged period. In addition, processing conditions have been established which provide a firm basis for setting conditions for future runs. The major problem during Run 010 continued to be the reliability of control instruments monitoring Unit 600 liquid streams.

51005 (FE—1517-72) **Coal liquefaction test center. Quarterly technical progress report, July—September 1978.** (Fluor Engineers and Constructors, Inc., Irvine, CA (USA)). Feb 1979. Contract EX-76-C-01-1517. 106p. P 06/MF A01.

Three periods of integrated operation involved 44 hours of coal extraction with 3 hours of integrated operations; 30 hours of coal extraction with 21 hours of integrated operations; and 142 hours of coal extraction and integrated operations. The hydrogenation portion of the plant processed various mixtures of fresh and stored extract material for 3, 56 and 339 hours during these runs. Run 011 was terminated when level instrument malfunctions allowed the extract/solvent mixture to overfill the first reactor. The mixture

congealed in the overhead cooler and plugged almost half of the tubes. Runs 012 and 013 were stopped when process fluids leaked through the internal pressure liner of a reactor recycle pump. In both cases the leak resulted in a fire. In Run 012 the incident occurred as the plant was being shut down due to operating problems with the carbonizer. The carbonizer problems resulted in the destruction of the internal lift-leg. The Run 013 incident happened during normal operations. The duration of integrated operations during Run 013 permits establishment of base conditions with which to compare future results. At an average hydrogenation temperature of 805°F, disappearance of the +880°F fraction in the hydrogenation feed (conversion) was 53%. The corresponding desulfurization was 90%. An average temperature of 735°F was achieved in the extractor; the observed depth of extraction was typically 77%. The 560°F temperature of the solvent deashing settling vessel was well below the preferred operating temperatures of 625 to 650°F. The lower temperature is due to heat loss and will be compensated for in future runs by utilization of an idle fired heater to reheat the settler feed.

51006 (FE—2044-37) **Partial liquefaction of coal by direct hydrogenation. Annual technical progress report, August 1977—July 1978.** Oberg, C.L.; Falk, A.Y.; Friedman, J. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). Feb 1979. Contract EX-76-C-01-2044. 74p. P 04/MF A01.

Rockwell International is developing a flash hydropyrolysis process for converting coal into high-value products. A high-mass flux, short-residence-time reactor is being used for this purpose. The process is based on a concept that high liquid yields are favored when coal is allowed to react with hydrogen for a brief period followed by rapid quenching. In the reactor, liquid products are formed initially, but these are further hydrogenated to gases if the reactions are not quenched. Rockwell has demonstrated successfully that flash hydropyrolysis can be carried out in an engineering scale reactor, with coal being processed at 1 ton/hr, which can be scaled directly to a commercial size. The reactor functions smoothly with caking (western Kentucky) coals and meets the coal conversion requirements of a commercial plant with no char product. During the first 9 months of the program, methods were developed for flowing the coal in dense phase with a small amount of transport gas. Cold-flow methods also were developed for characterizing the transport and mixing processes of the coal. Results from this characterization allow near-optimum design of the injector. The effectiveness of the reactor concept has been demonstrated in a series of tests. Twenty-one reactor tests were made at a nominal coal flow rate of 1/4 ton/hr. Twenty-four additional tests were made at a nominal coal flow rate of 1 ton/hr. (LTN)

51007 (FE—2307-46) **Research and development of rapid hydrogenation for coal conversion to synthetic motor fuels (riser cracking of coal). Third quarter report, October 1—December 31, 1978.** Duncan, D.A.; Beeson, J.L.; Oberle, R.D. (Institute of Gas Technology, Chicago, IL (USA)). Mar 1979. Contract EX-76-C-01-2307. 46p. P 03/MF A01.

Work on processing of caking coals was continued, and methods of pretreating caking coals have been developed and demonstrated by successful runs in the bench-scale unit. Exploratory work was also done to evaluate the effects of bentonite clay, iron oxide, and heating rate on the reaction system. Both bentonite clay and iron oxide were found to have beneficial catalytic effects. Depth of carbon conversion was found to be more a function of severity of thermal treatment than heating rate over the range studied. Construction of the progress development unit (PDU) was continued, and much of the major equipment has been received. Contracts have been made for supplying high-pressure gases to the PDU. Fabrication of the preheater coil has been completed, and construction of the preheater furnace is underway. Tests were continued in a low-pressure simulator of a PDU combustor section, and for a coaxial construction, ceramic shields in the vicinity of the oxygen injection point do not appear to be necessary.

51008 (FE—2537-11) **Characterization of coal-derivediquids and other fossil fuel related materials employing mass spectrometry. Quarterly report, March 30—June 29, 1979.** Scheppele, S.E. (Oklahoma State Univ., Stillwater (USA). Dept. of Chemistry). 3 Aug 1979. Contract EX-76-S-01-2537. 11p. P 02/MF A01.

Extensive annual maintenance was performed on the mass spectrometer and ancillary equipment. The technique of micromolecular probe distillation-FI/MS was applied to the characterization of petroleum heavy ends. In this regard, the available standards for converting ion time centroids to ion m/e values in the high m/e region is inadequate. Development of a computer method for assigning most probable formulas to precise ion masses was completed. Considerable progress was made in preparing three manuscripts describing the method. The initial phase of a project which attempts to predict relative FI sensitivities from molecular parameters was completed. The effort to develop FI/MS as a technique for analyzing saturate hydrocarbons was extended to encompass total crude oils and the saturate fractions isolated from them. Preparation of publications describing our extensive characterization of the oils and asphaltenes from a COED coal liquid were essentially completed. The presence of numerous aromatic compounds containing two nitrogens in an anthracene oil was demonstrated. Characterization of an SRC-II coal liquid was initiated.

51009 (FE—2588-19) **Study of ebullated bed fluid dynamics for H-Coal. Quarterly progress report No. 5, December 1, 1978—February 28, 1979.** Vasalos, I.A.; Bild, E.M.; Jones, J.W. (Amoco Oil Co., Naperville, IL (USA). Research and Development Dept.). Mar 1979. Contract EF-77-C-01-2588. 74p. P 04/MF A01.

Coal-fine plugging problems in the unit were alleviated by the addition of nitrogen purge lines to the system. To prevent plugging problems, lines are purged when the unit is shut down. Once a plug develops, the nitrogen blast is used to free the line. The initial catalyst level was lowered to prevent catalyst carryover in the recycle cup. Key experiments with nitrogen, kerosene, HDS-2A catalyst (3/16" length) and with coal concentrations of 11.5, 15, and 16.5 vol % were completed. Experiments with 16.5 vol % slurries were also conducted at 100°F and 150°F in addition to those at 75°F. Bed expansions were determined with gamma-ray scans of the reactor length for each test. Liquid holdups were determined by gamma-ray scans and DP measurements. Data obtained at different reactor and operating conditions were correlated with models identified during the literature search. The liquid/catalyst data were correlated with the Richardson—Zaki equation. This relates the liquid holdup to the nth power to the ratio of liquid superficial velocity to the catalyst terminal velocity. The index, n, increases with coal char concentration and decreases with increasing temperature. Gas/liquid/catalyst data were correlated using the drift flux correlation of Darton and Harrison. It was found that increasing coal concentration and lowering temperature enhanced the transition from ideal bubbly to churn turbulent flow - the unstable bed operation. Additional data were also obtained by using argon-41 radioactive tracer tests.

51010 (FE—2766-13) **Gasifier study for Mobil coal to gasoline processes. Final report.** Shinnar, R.; Kuo, J.C.W. (Mobil Research and Development Corp., Paulsboro, NJ (USA)). Oct 1978. Contract EX-77-C-01-2766. 201p. P 10/MF A01.

In a previous paper, it was shown that the indirect route via gasification and synthesis provides a very promising route for high grade fuels, both for the near range and for the long range. The gasifiers and the associated offsites that produce the synthesis gas are a large part of the cost of a complex to produce high quality transportation fuels. The thermal efficiency of this gasification step is also a large contribution to the overall thermal efficiency of the complex. To fully utilize the advantage of this route, it is important to develop better gasifiers and to match the synthesis processes such that they take full advantage of such a gasifier. The objective of this study was to evaluate which of the gasifiers presently under development could meet this goal. This study shows that synthesis gas at the lower ratios of H_2 to CO and steam to oxygen has inherent thermal efficiency advantages which arise from basic scientific and engineering principles. Gasifiers that can be made to operate consistent with these principles have a substantial cost advantage. The cost advantages are demonstrated by a differential economic analysis essentially independent of the absolute values of the cost basis. The British Gas Corporation-Lurgi slagging gasifier, which is present close to commercialization, conforms closely to the basic requirement and potentially could produce syngas at a low production cost relative to other gasifiers such as the dry ash Lurgi gasifier. The H_2 to CO and steam to oxygen ratios of this gasifier are about 0.5 to 1.3, respectively, very close to the best theoretical values of 0.45 and 1.6, respectively. The low H_2 to Co ratio gasifiers have to be matched with syngas conversion processes that use such low ratios. (LTN)

51011 (IS—4655, pp 91-107) **Materials and components: alloy evaluation for fossil fuel process plants (liquefaction).** Woods, C.; Scott, T. May 1979.

In Fossil Energy Program. Technical progress report, October 1—December 31, 1978. I. Mining Research and Development-Coal Preparation and Analysis. II. Advanced Research and Technology Development.

Room temperature mechanical properties have been determined for A387-74A-Gr. 22-C1.2 steel after exposure for 168 hours at 500 or 800°F in a coal slurry with 4000 psig hydrogen pressure or for 1000 hours at 800°F in 4000 psig argon. Comparison of ambient temperature mechanical properties occurred. Mechanical properties investigated include 0.2% yield stress, ultimate tensile strength, uniform elongation, total elongation, engineering fracture stress, true fracture stress, reduction in area, and notch tensile strength. Results of the various exposure tests are given in tables. Average values are summarized and compared with the previously determined room temperature tensile properties. These values are statistical averages based on data certified by the Q test at the 90% confidence level. It can be seen that the room temperature mechanical properties of A387-74AGr.22-C1.2 steel were not appreciably affected by pro-

longed (168 hour) exposures to the coal slurry environment or to 1000 hour exposures to 800°F, 4000 psig Argon gas.

51012 (SAND—79-1400) **Coal liquefaction short residence time process research, 79-1. First quarterly report, October 1—December 31, 1978.** Traeger, R.K.; Bickel, T.C. (Sandia Labs., Albuquerque, NM (USA)). Jul 1979. Contract EY-76-C-04-0789. 27p. P 03/MF A01.

The bench scale coal liquefaction reactor is being modified to increase the accuracy of data required for kinetic studies, and to also extend the region of operation of the reactor. Preliminary concepts have been identified for residence time measurements and further studies are underway to evaluate performance under reaction conditions. Current concepts include: solid phase residence time—magnetic tracer particles or manganese oxide with neutron activation; and liquid phase residence time—reflectance IR or high speed sampling with an organic tracer, radioactive tracer. Limited viscosity and surface tension measurements have been performed in an effort to predict the reactor flow regime.

51013 Aromatic nitrogen compounds in fossil fuels: a potential hazard. Ho, C.H.; Clark, B.R.; Guerin, M.R.; Ma, C.Y.; Rao, T.K. (Oak Ridge National Lab., TN). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **24**: No. 1, 281-291(1979). (CONF-790415—P2).

From 177. national meeting of the American Chemical Society; Honolulu, HI, USA (1 Apr 1979).

The nitrogen content either of shale oil (1 to 2%) or coal derived oil (1 to 1.5%) is far higher than that in petroleum (average N-content in petroleum is 0.05 to 0.1%). This means enormous amounts of nitrogen containing species will be produced and found in crude synfuels, and this could lead to significant health or environmental impact. Clearly, a thorough characterization of nitrogen compounds in synfuels is an important pursuit. Aromatic nitrogen compounds such as basic aza-arenes, neutral aza-arenes, and aromatic amines are considered environmentally important and several members of these classes of compounds possess biological activity. For example, dibenz(a,h)acridine, 7 H-dibenzo(c,g)carbazole, and 2-naphthylamine, are well known as carcinogens. In this paper, the methods used to isolate the basic aromatic nitrogen compounds and neutral aza-arenes from one shale oil and one coal-derived oil are discussed. The mutagenic activities of these fractions, based on the Ames Salmonella typhimurium test is compared. The acetone subfracion of shale/oil was about half as mutagenic as benzo(a)-pyrene while the coal-derived oil subfraction was about four times more active. GC/MS data indicate multi-ring aza-arenes comprised a large portion of the acetone subfraction, e.g. aza-benzoperylene, aza-indenopyrene, and aza-coronene have been identified. The presence of aromatic amines in the active subfraction from both oil samples was first suggested from their IR spectra. This finding may mean that the primary aromatic amines as well as multi-ring aza-arenes are producing the mutagenic activities of the acetone subfractions. A logical extension of this work is to further separate the acetone subfraction into primary amines and multi-ring aza-arenes. This should lead to some important conclusions regarding the mutagenic effects of these classes of compounds.

51014 Chemical and mineralogical characterization of coal liquefaction residues. Dreher, G.B.; Russell, S.J.; Ruch, R.R. (Geological Survey, Urbana, IL). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **24**: No. 1, 309-319(1979). (CONF-790415—P2).

From 177. national meeting of the American Chemical Society; Honolulu, HI, USA (1 Apr 1979).

Data from the limited number of sample sets covering several liquefaction processes indicate that relatively few elements (e.g. Hg, S, As, Br, and B) are consistently lost to any significant degree from the resultant residues. Only a few mineralogical changes occur during the process in which the transformation of pyrite to pyrrhotite most consistently occurs. These experimental observations, including the general range of elemental concentrations found in the residues, along with extensive trace element distribution data now available from analyses of many coals from the various US coal fields, will be used for an economic evaluation for many metals. Trace element concentrations for such economically significant metals such as Au, Ag, Pt, Pd, Ta, etc. in most cases will probably be too low for consideration as resources. In some cases, however, such as Zn, there are areas where concentrations are high enough for serius consideration. The more abundant metal in coal - such as Al, Fe, Si, and possibly Ti - although perhaps currently not economical to extract may require attention in the future.

51015 Development and demonstration of the H-Coal Process. Comolli, A.G.; Battista, C.A.; Johanson, E.S.; Laird, C.P. (Hydrocarbon Research, Inc., Lawrenceville, NJ). *Prepr., Div. Pet. Chem., Am. Chem. Soc.;* **23**: No. 4, 1297-1305(Sep 1978). (CONF-780902—P4).

From American Chemical Society meeting; Miami, FL, USA (10 Sep 1978).

H-Coal, a catalytic hydroliquefaction process developed by Hydrocarbon Research, Inc. for conversion of coal to high-quality, clean liquids, has advanced to the stage of commercial evaluation with the construction in Catlettsburg, Kentucky of a 600 ton/day pilot plant which will produce up to 2,500 barrels per day of liquid product. The H-Coal Process was invented by HRI, and has been under development for over 15 years. The program was initially funded by Dynalectron Corporation, the parent company of HRI and by the Office of Coal Research and Atlantic Richfield Company. Currently the sponsors are the Department of Energy, the Electric Power Research Institute, Ashland Oil, Standard Oil Company of Indiana, Conoco Coal Development Company, Mobil Oil Corporation and the Commonwealth of Kentucky. The development and demonstration of the H-Coal Process has been carried out on bench-scale units processing 25 pounds of coal per day and in a Process Development Unit (PDU) handling 3-1/2 tons per day. Fourteen coal types have been evaluted - for a total of more than 52,000 hours of cumulative pilot plant operating experience. There were three distinct tasks in this experimental program: bench unit tests, PDU operations and the development of systems and correlative hardware to overcome some of the operating problems defined during the experimental testing and engineering design work. PDU studies concentrated on confirming the design basis and operating conditions for the fuel oil mode of operation in the pilot plant. In addition, a solid—liquid separation system and a new type of hydroclone were designed and tested. With the successful completion of the Phase I program, HRI moved to the second phase experimental support studies for optimum design and operation of the H-Coal Pilot Plant.

51016 Effect of catalyst pore structure on the hydroprocessing of coal-derived liquids. Chiou, M.J.; Olson, J.H. (Univ. of Delaware, Newark). *Prepr., Div. Pet. Chem., Am. Chem. Soc.;* **23**: No. 4, 1421-1436(Sep 1978). (CONF-780902—P4).

From American Chemical Society meeting; Miami, FL, USA (10 Sep 1978).

The durability and effectiveness of the catalyst used in hydroprocessing of coal-derived liquids are some of the major concerns in commercializing the production of clean fuels from coal. Owing to the differences in chemical composition and certain physical properties between coal liquid and petroleum stocks, catalysts efficient for petroleum may not be suitable for the hydrotreating of coal liquid. This laboratory has studied the physical and chemical properties of the spent catalysts used in the hydroprocessing of coal-derived liquids to determine deactivation mechanisms. It is concluded that depositions of both mineral matter and coke are primary causes for catalyst deactivation. This paper concerns physical rather than chemical properties of the catalyst. The effects of pore plugging and geometrical exclusion on the catalytic behavior in the H-coal hydroprocess have been studied. A kinetic model correlating the decline of effective diffusivity with hindered diffusion and coke laydown is proposed. The results demonstrate that physical properties of both catalyst and reacting molecules have a decisive effect on the loss of the catalyst life and the nature of coke formation. The profiles for coke laydown demonstrate the dramatic effects of pore plugging coupled with geometrical exclusion. Although a complete modeling of hydroprocessing must include the effect of the coke deposit on the main hydroprocessing reactions such as HDS, HDN and HDM etc., this study of three models for coke deposition yields the basic characteriztion for more complicated systems. There is potential for improving hydroprocessing processes by control of catalyst physical properties.

51017 New tools in catalysis. Advances in synthetic fuels. Effect of pore size on catalytic behavior. Washington, DC; American Chemical Society (1978). 230p. (CONF-780902—P4).

From American Chemical Society meeting; Miami, FL, USA (10 Sep 1978).

The Division of Petroleum Chemistry of the American Chemical Society held a meeting at Miami Beach, Florida, September 10—15, 1978. The meeting was especially involved with catalysts and included symposia on New tools in Catalysis, Advances in Synthetic Fuels, and Effect of Pore Size on Catalytic Behavior. Eighteen papers were entered individually into EDB and four also into ERA. Two papers had been entered previously from other sources. (LTN)

PYROLYSIS AND CRACKING

REFER ALSO TO CITATION(S) 50969

SOLVENT EXTRACTION

51018 SRC-II: review of development and status. Jackson, D.M.; Schmid, B.K. pp 331-346 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Recent experience in large pilot-plant operations with the SRC fuel-oil process on a variety of high-sulfur bituminous coals has demonstrated technical feasibility of the process for producing a clean coal-derived fuel oil and by-product SNG. Product characterization and testing of the SRC fuel-oil product indicates potential for displacement of petroleum fuel oil in industrial and utility boilers. Large-scale combustion testing was scheduled for the 1st half of 1978. Low-ash and low-trace-element levels suggest further application as gas-turbine fuel. Demonstration in a full-size process train capable of modular expansion is recommended to meet national goals of timely develoment. The Solvent Refined Coal process has been under develoment by Gulf and its subsidiary, the Pittsburg & Midway Coal Mining Co. (P & M), for fifteen years, primarily under the sponsorship of the Department of Energy and its predecessor agencies. Much of the earlier development work was carried out on a version of the process now known as SRC-I. The experimental work has progressed from laboratory research started in 1962, to a 50 TPD pilot plant at Ft. Lewis, Washington including operation of a 1-T/D integrated pilot plant at Gulf's Harmarville, Pennsylvania research center. The experimental data from the pilot plant has been supplemented by additional laboratory work at P & M's Merriam laboratory throughout this period, and by engineering studies for large-scale plants since 1974. A brief summary of the historical development of the process is given.

BY-PRODUCTS

REFER ALSO TO CITATION(S) 51195, 51874

51019 Alternate fuels for the FIOR direct reduction process. Kulberg, H.A.; Drews, S.F. (Arthur G. McKee and Co., Independence, OH). pp 3.1-3.15 of Fiftieth annual meeting of the Minnesota Section, AIME; thirty-eighth annual mining symposium. Graven, L.K. (comp.). Minneapolis, MN; Univ. of Minnesota (1977).

From 38. mining symposium; Duluth, MN, USA (12 Jan 1977).

The FIOR process, as most direct reduction processes, requires a source of gaseous reductant which, along with iron ore, is the principal raw materials to the plant. Sources of fuel for reducing gas generation are a major concern in new plant location and overall project economics, especially in light of the general tight supply of natural gas. There are several alternate fuels to natural gas which can be utilized in commercially proven processes to supply reducing gas to a FIOR plant. This report discusses some of the processes for converting other fuels to a reducing gas suitable to the FIOR process and provides a general economic comparison with reducing gas generation from natural gas.

51020 SL/RN Process at the Griffith Mine. Wilson, K. (Steel Co. of Canada, Ltd., Hamilton, Ontario). pp 4.1-4.12 of Fiftieth annual meeting of the Minnesota Section, AIME; thirty-eighth annual mining symposium. Graven, L.K. (comp.). Minneapolis, MN; Univ. of Minnesota (1977).

From 38. mining symposium; Duluth, MN, USA (12 Jan 1977).

In May 1975, Stelco's first commercial direct reduction kiln began operating, based on the SL/RN Process. Sponge iron has been successfully produced in New Zealand, Brazil and Japan by the SL/RN Process, a process developed jointly by Stelco, Lurgi Chemie, Republic Steel Company, and NL Industries. However, the Griffith Mine installation, the culmination of more than 17 years of intensive effort by Stelco and its partners, has many unique features because of its size and the combination of raw materials with which it is fed. This paper describes the plant layout and gives the latest operating results.

51021 Update of Midrex direct reduction techniques and innovations. Keaton, D.L. (Midrex Corp., Charlotte, NC); Pietsch, W.P. pp 5.1-5.23 of Fiftieth annual meeting of the Minnesota Section, AIME; thirty-eighth annual mining symposium. Graven, L.K. (comp.). Minneapolis, MN; Univ. of Minnesota (1977).

From 38. mining symposium; Duluth, MN, USA (12 Jan 1977).

In summary, the ten most important innovations and improvements developed for the MIDREX Direct Reduction Process are: wider choice of raw materials, including lump ores; utilization of oxide fines; alternate flow sheet, allowing the use of raw materials with sulfur contents less than or equal to 0.02%; lower fuel consumption; use of alternate fuels; improved production rates; control of product metallization between 86 and 96%; carbon control between 1 and 3%; Midrex cold briquetting of metallized fines; and CHEMAIRE Oxidation Inhibiting Process.

51022 Peat as a pelletizing binder. Glumac, G. pp 22.1-22.3 of Fiftieth annual meeting of the Minnesota Section, AIME; thirty-eighth annual mining symposium. Graven, L.K. (comp.). Minneapolis, MN; Univ. of Minnesota (1977).

From 38. mining symposium; Duluth, MN, USA (12 Jan 1977).

Peat mixed with clay can replace bentonite as a binder in the production of iron ore pellets without disrupting current operating practices. (LTN)

PROPERTIES

REFER ALSO TO CITATION(S) 50931, 50947, 50952, 50966, 50969, 50972, 51008, 51082, 51090

51023 (CONF-790630—, pp 419-428) **Reaction of coke particles with air: effect of diffusion on reaction rate.** Mohan, R.; McKinley, M.D.; Douglas, G.W. (Univ. of Alabama, University). May 1979.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Single cubes of coke made from bituminous coal were reacted with air in a thermogravimetric apparatus to determine the relative importance of external diffusion, diffusion through the ash, and chemical reaction rate. Cubes 2.54 cm and 1.27 cm in size were used, and reaction temperatures ranged from 750 to 984 K (890 to 1311 °F). The air mass velocity in the reaction tube was 9 to 18 g/cm² hr. The data were analyzed by a shrinking core model which included both extra-particle and intra-particle diffusion effects. The diffusion of oxygen through the ash layer was the major factor controlling the overall reaction rate. The diffusivity of oxygen through the ash layer was found to be 0.69 cm²/sec and was not affected by temperature, particle size, O_2 concentration, or gas flow rate.

51024 (CONF-790630—, pp 429-435) **Applications of cross polarization magic-angle spinning carbon-13 NMR to in situ coal gasification.** Miknis, F.P. (Dept. of Energy, Laramie, WY); Bartuska, V.J.; Maciel, G.E. May 1979.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Carbon-13 nuclear magnetic resonance with cross polarization and magic-angle spinning is a state-of-the-art nuclear magnetic resonance technique that can provide detailed structural information about the carbon distribution in solid materials. For complex organic materials, such as coals, the cross polarization magic-angle spinning techniques provide a direct, nondestructive measurement of an important coal parameter - the carbon aromaticity. Cross polarization magic-angle spinning techniques have been applied to a series of coal samples obtained from the Department of Energy's Underground Coal Gasification site near Hanna Wyoming. Aromaticities thus obtained have been used to assess the nature of the carbon distribution in the Hanna No. 1 coal seam, to assist with the location of process wells for in situ experiments, and to determine whether changes in the aromaticity of coals that have been heated can be used to assess the extent and temperatures of carbonization achieved during underground coal gasification processing. These applications and the nature of the cross polarization magic-angle spinning experiment are described.

51025 (FE—2286-32) **Preparation of a coal conversion systems technical data book. Project 61003 annual report, May 1, 1977—April 30, 1978.** (Institute of Gas Technology, Chicago, IL (USA)). Feb 1979. Contract EX-76-C-01-2286. 577p. P 25/MF A01.

In this report, we have discussed the calculation of gas phase fugacity in NH_3—H_2S—H_2O and NH_3—CO_2—H_2O systems. We have presented Vapor-Liquid Equilibrium data on cyclohexane-water and four binary hydrogen-solvent systems: H_2-tetralin, H_2-diphenylmethane, H_2-1, methylnaphthalene and H_2-bicyclohexyl. New data obtained on true densities of low rank coals and their chars are plotted as a function of hydrogen content (wt %, daf). Results of an investigation of formulas for calculating the heating value of coal from its composition are given. A new formula, developed from the available data and having the least standard deviation is also presented. Data on minor and trace elements in coal are reviewed. A table of basic properties of pure components of coal liquids is included. Properties of benzene are presented in both S.I. and British Units. We have discussed the theory of coal cleaning equipment and described the performance characteristics of dense-medium cyclones, hydroclones, concentrating tables, dense-medium coal vessels and Baum jigs. Equilibrium constants of various coal conversion and related reactions are tabulated and also given in graphical form. We have recommended Kouno and Saito's correlation for calculating pressure drop in vertical dilute phase lift lines. We have also discussed the general flow characteristics of gas-solids mixtures in horizontal lines and evaluated various correlations available in the literature for estimating saltation velocity by comparison with available experimental data. We also reviewed the literature on correlations for pressure drop calculations in dilute phase horizontal gas-solid flow systems. (LTN)

51026 (IS—4655, pp 9-61) **Microstructure of coal.** Greer, R.T. (Iowa State Univ., Ames). May 1979.

In Fossil Energy Program. Technical progress report, October 1—December 31, 1978. I. Mining Research and Development-Coal Preparation and Analysis. II. Advanced Research and Technology Development.

Polished cross sections through particles representative of samples listed provide evidence for partial reaction of pyrite particles in the desulfurization treatments. All treated coals listed contain partially reacted pyrite particles of the general form indicated in figures. A reaction rim of the order of 3 to 6 micrometers in thickness surrounds unreacted pyrite crystals. When the original pyrite was less than several micrometers in diameter, complete transformation seems to occur. For the case of pyrite framboids (berry-like agglomerations of small individual pyrite single crystals), reaction occurs primarily at the outer exposed surfaces of a framboid with some reaction also occurring within a framboid along grain boundaries. Initial optical microscope studies indicate a primary fine grained reaction product (primarily one phase, although there is evidence for minor amounts of more than one phase transformation product). Electron microprobe work confirms the presence of sulfur and iron in the reaction rim. Additional work is necessary to confirm that the major phase is pyrrhotite. (LTN)

51027 (IS—4655, pp 62-65) **Selective magnetic enhancement of pyrite in coal by dielectric heating.** Bluhm, D.; Fanslow, G.; Simpson, R. May 1979.

In Fossil Energy Program. Technical progress report, October 1—December 31, 1978. II. Mining Research and Development-Coal Preparation and Analysis. II. Advanced Research and Technology Development.

A number of studies have shown that the magnetic susceptibility of pyrite can be enhanced by heating, however, the problem in heating pyrite in coal is that of also heating the coal. This could result in a pyrolysis of the coal in addition to being a waste of energy. A possible solution to this problem is the selective dielectric heating of pyrite in coal with a minimal heating of the coal. This may be accomplished if the dielectric properties of pyrite and coal differ sufficiently so the pyrite absorbs more electromagnetic energy and heats faster than the coal. Thus, the initial phase of this study was to determine the dielectric properties of pyrite and coal. The dielectric properties of the coal and pyrite have been measured at 27.1 MHz and 2.45 MHz. (LTN)

51028 (IS—4655, pp 66-67) **Organosulfur components in coal.** Squires, T. May 1979.

In Fossil Energy Program. Technical progress report, October 1—December 31, 1978. I. Mining Research and Development-Coal Preparation and Analysis. II. Advanced Research and Technology Development.

In order to improve existing techniques and develop new methods for the chemical desulfurization of coal, the chemistry of the organosulfur constituents of coal is being systematically investigated using model organosulfur compounds, various sulfur containing coal fractions, and whole coal. Evaluation of the effectiveness of the Ames oxydesulfurization process will continue using whole coal and coal fractions as well as model organosulfur compounds. In conjunction with this project, Dr. J.M. Harris of the University of Alabama is presently investigating catalysts for effecting the oxidation of sulfidic functions.

51029 (IS—4655, pp 68-70) **Instrumentation: rapid analysis of mineral content of coals: development of an on-line monitoring instrument for pyrite and ash in coal.** Benson, J.; Jacobson, R. May 1979.

In Fossil Energy Program. Technical progress report, October 1—December 31, 1978. I. Mining Research and Development-Coal Preparation and Analysis. II. Advanced Research and Technology Development.

We have been able to detect 0.1% pyrite in a charcoal matrix using longer counting times of 30 seconds per step. The intensity of the pyrite peaks is such that at a faster counting time of 5 seconds per step we can readily detect 0.2% pyrite in charcoal. We intend to try shorter counting times and if the trend continues, determine counting times for lower limits of 0.3 to 0.4% pyrite (0.15 to 0.2% pyritic sulfur). Using both literature values for diffraction patterns and direct observation, none of the common non-sulfide minerals will cause significant problems with the diffraction pattern of pyrite. Marcasite (also FeS_2) and sphalerite (Zn,FeS) have diffraction patterns that overlap the pyrite pattern. We have taken this into account, and it is for this reason that we intend to measure the intensity of two pyrite peaks. The first peak that we measure will contain information on the amount of pyrite and marcasite present in the coal. The second peak will be from pyrite only. By knowing the relative intensity of the first peak to the second, it will be possible to calculate the percentages of both minerals. We can readily detect 0.2% pyrite in charcoal using present methods of data collection. We have determined calibration curves for our present instrument for percentage pyrite from 0.25 to 15%. We obtain a straight line with about 1000 counts difference for each percent change in pyrite. From 0.25 to 10% the straight line had a degree of fit of 0.998. When this is extended to include the total range, the degree of fit falls to 0.989. We feel that the thick samples we are using are being affected by adsorption at the higher concentrations of pyrite, and this will be studied in the near future.

51030 (IS—4703, pp 1-8) **Microstructure of coal.** Greer, R.T. Jun 1979.

In Fossil Energy Program. Technical progress report, January 1—March 31, 1979. I. Mining Research and Development: Coal Preparation and Analysis.

Microstructural phenomena of phase transformations resulting from various reactor conditions for effective desulfurization of pyrite have been monitored and identified to contribute information toward process improvement. Organic sulfur distribution and concentration differences within and among macerals are being demonstrated by sensitive x-ray wavelength shift studies. The investigations intend to establish how processing affects removal of organic sulfur and other forms of sulfur, as well as to directly quantify changes. The effects of chemical leaching on pyrite have been studied in detail by x-ray diffraction, electron microprobe, optical microscopy and scanning electron microscopy. The primary fine grained reaction product has been identified for material leached with hot, dilute solutions of sodium carbonate containing dissolved oxygen under pressure. These tests expand on the microstructural—chemical information introduced in the preceeding report. In addition, phase transformation products from pure pyrite were studied for pyrite samples reacted in a tubular bed reactor and in an autoclave.

51031 (IS—4703, pp 9-11) **Rapid analysis of mineral content of coals: development of an on-line monitoring instrument for pyrite and ash in coal.** Jacobson, R.A.; Benson, J.E. Jun 1979.

In Fossil Energy Program. Technical progress report, January 1—March 31, 1979. I. Mining Research and Development: Coal Preparation and Analysis.

In our original design of the pyrite and ash monitor, our idea was to keep the cost of the final instrument to a minimum. With this in mind, we used a beta filter (a very thin piece of zirconium foil that is placed in the x-ray beam to absorb the K/sub β/-x-ray wavelength) in place of a crystal monochromator. The monochro'ator holder cost $2,000 to $6,000 depending on the brand, and the crystals cost $750 to $1000 per square inch. The main advantage of the monochromator is the reduction in background radiation that reaches the x-ray detector. This became very apparent when we were collecting qualitative data for the other groups. We observed features of the coal diffraction pattern that were completely hidden by the high background at low diffraction angles. It is also in this low angle region some minerals such as gypsum have their most intense diffraction lines. We have redetermined our calibration curve, i.e., peak intensity for the two diffraction lines for pyrite versus percent pyrite, using a monochromator. We find that we get a much better fit to a straight line, and the steeper slope of the line indicates even more sensitivity to pyrite concentration.

51032 (IS—4703, pp 12-26) **Coal blending experiments.** Biggs, D. Jun 1979.

In Fossil Energy Program. Technical progress report, January 1—March 31, 1979. 1. Mining Research and Development: Coal Preparation and Analysis.

The objective of this research is to determine the mineralogy and fusion properties of ash taken from various coals and blends of coals with a view toward establishing better criteria for forming coal blends that will have the least possible fouling and slagging properties and the greatest energy release. To date coal samples have been taken from two mines, the Decker Mine near Decker, Wyoming and the Dahm Mine near Marysville, Iowa. The coal samples have been split for use as both raw and washed coals and blends formed from the raw coal. Both the whole coals and their blends have been subjected to low temperature ashing techniques in the raw state. The fraction of the sample set aside for that purpose has been washed and remains to be blended and ashed. Work is microscopic study of the mineral matter in the Dahm coal has proven interesting and, for the purposes of understanding the reactions of the ash upon burning, significant. The minerals identified in the coal are carbonates of varying composition, clays, pyrite and marcasite. The clay minerals are predominantly found filling open spaces and in contact with the other minerals only where fractures in the coal cross other mineral segregations. The carbonates, pyrite and marcasite, on the other hand, are intimately associated with each other and with the macerals of the coal. Some of the minerals give evidence of early crystallization, preserving plant structures that are commonly obliterated in later stages of coalification and others have crystallized much later, some perhaps quite recently in the history of the deposit. Pyrite is observed both replacing coal and other minerals and being replaced by the carbonate crystals. The intimately mixed carbonate and sulfide minerals will probably affect the formation of fouling deposits. (LTN)

51033 Chemical studies of stack fly ash from a coal-fired power plant. Coles, D.G.; Ragaini, R.D.; Ondov, J.M.; Fisher, G.; Silberman, D.; Prentice, B.A. (Univ of Calif, Lawrence Livermore Lab). *Environ. Sci. Technol.;* **13**: No. 4, 455-459(Apr 1979).

Concentrations of 42 minor and trace elements in four size fractions of stack fly ash from a large Western coal-fired power plant are reported. Mass median diameters of the four size fractions were 2.4, 3.7, 6.0, and 18.5 ;mu;m. Based on the enrichments relative to coal as a function of fly-ash particle size, the elements are grouped into three classes: Group I, elements that show little or no enrichment in the small particle fraction; Group II, elements whose enrichments increase with decreasing particle size; and Group III, elements whose behavior is intermediate to that of elements in Groups I and II. The elements in Groups I and II are described in terms of their lithophilic and chalophilic geochemical behavior, respectively. The chemical behavior of individual elements in Group III is discussed. 40 refs.

51034 Transmitted near-infrared microscopy of coal. Harris, L.A.; Yust, C.S. (Oak Ridge Natl Lab, Tenn). *Fuel;* **58**: No. 4, 253-256(Apr 1979).

Thin sections of an eastern Kentucky high-splint coal (high-volatile bituminous) from the Thiessen collection have been studied using transmitted infrared microscopy. Several normally opaque structures in the inertinite maceral group were observed to transmit in the near infrared (700-1200 nm). These same structures were also found to be birefringent, consisting of variably oriented optical domains similar in appearance to a polycrystalline material. This technique may prove valuable in studies of seam profiles and correlations. 7 refs.

51035 Evaluation of solvents for carbon-13 NMR analysis of solvent-refined coals. sym-Triazine a new carbon-13 NMR solvent. Saito, K.; Baltisberger, R.J.; Klabunde, K.J.; Stenberg, V.I.; Woolsey, N.F. (Univ of ND, Grand Forks). *Fuel;* **58**: No. 4, 315-317(Apr 1979).

Solvent-refined lignite (SRL) and bituminous coals (SRC) are only partially soluble in good standard carbon-13 n.m.r. solvents. A survey of other possible solvents for SRLs and SRCs showed that sym-triazine at 86;degree;C solvated SRL as well as pyridine, but did not absorb in the regions of interest (5-60 and 90-160 ppm relative to TMS). Model hydrocarbons, phenols and an alcohol in sym-triazine gave aromaticities (f;sub a;) accurate within the standard deviation (0.01 to 0.001) when proper Fourier transform carbon-13 techniques were used. Diethylstilboesterol and benzylamine reacted with sym-triazine and gave inaccurate values of f;sub a;. 21 refs.

51036 World fuels. Structure of coal. Trace elements and hazardous compounds in fossil fuels. Washington, DC; American Chemical Society (1979). 334p. (CONF-790415—P2). Inst. of Gas Tech. Library, 3424 S. State St., Chicago, IL $8.00.

From 177. national meeting of the American Chemical Society; Honolulu, HI, USA (1 Apr 1979).

Volume 24, No. 1, contains preprints of papers presented at Honolulu, Hawaii, April 2—6, 1979, to the Division of Fuel Chemistry of the American Chemical Society. Symposia were held in World Fuels, Structure of Coal and Trace Elements and Hazardous Compounds in Fossil Fuels. Thirty-nine papers were entered individually into EDB and 12 also into ERA. (LTN)

51037 Nature of the free radicals in coels, pyrolyzed coals, and liquefaction products. Retcofsky, H.L. (Pittsburgh Energy Technology Center, PA); Hough, M.R.; Clarkson, R.B. *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **24**: No. 1, 83-89(1979). (CONF-790415—P2).

From 177. national meeting of the American Chemical Society; Honolulu, HI, USA (1 Apr 1979).

In contrast to the ESR spectra of coals, which generally consist of a single line devoid of any resolvable fine structure due to hyperfine intreactions, the ENDOR spectra (at least in the present study) are rich in detail. These results are quite surprising in light of spectra published several months ago which showed only a single band at the so-called free proton frequency . In an attempt to experimentally deduce the reasons for this apparent discrepancy of results, we found a reversible effect of air (oxygen) on the ENDOR spectrum, i.e., the hyperfine lines were observed for evacuated samples, but disappeared upon admission of air to the samples. The fact that an ENDOR spectrum is observed under the experimental conditions employed is unambiguous proof that the unpaired electrons in the coal couple with nuclear spins, undoubtedly protons, in the sample. This provides additional support for the free radical interpretation of the ESR spectrum. The magnitude of the hyperfine interactions, i.e., none greater than 10 gauss, indicates that none of the radicals has a high unpaired electron spin density at a particular carbon atom.

51038 Tentative identification of average aromatic ring size in an Iowa vitrain and a Virginia vitrain. Gerstein, B.C.; Ryan, L.M.; Murphy, P.D. (Ames Lab., IA). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **24**: No. 1, 90-95(1979). (CONF-790415—P2).

From 177. national meeting of the American Chemical Society; Honolulu, HI, USA (1 Apr 1979).

In the present work, cross polarization to enhance sensitivity combined with strong heteronuclear decoupling and magic angle spinning to remove heteronuclear dipolar broadening and chemical shift anisotropy broadening are used to distinguish aliphatic from aromatic ^{13}C in Pocahontas No. 4 vitrain, and Star vitrain. Combined rotation and multiple pulse (NMR) spectroscopy (CRAMPS) are similarly used to narrow NMR spectra of ^{1}H in these coals. The ratios of aliphatic to aromatic ^{1}H and ^{13}C thus inferred are used to estimate an average aromatic ring size in the samples investigated.

51039 Temperature dependence of ^{1}H NMR absorption in coal and pitch. Miyazawa, K.; Yokono, T.; Sanada, Y. (Hokkaido Univ., Sapporo, Japan). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **24**: No. 1, 96-103(1979). (CONF-790415—P2).

From 177. national meeting of the American Chemical Society; Honolulu, HI, USA (1 Apr 1979).

Many kinds of reactions such as pyrolysis, depolymerization, condensation occur simultaneously in complicated way when coal and tar pitch are heated over temperature range from 350°C to 500°C. In order to understand the processes of coal liquefaction and coal carbonization, it is important to clarify the characteristics of reaction behaviors for coal and tar pitch over the temperature range. It is well known that pitch, solvent refined coal (SRC) and coking coal produce various kinds of mesophase at the early stages of carbonization. The mechanism of many chemical reactions and physical transformations relating to mesophase formation are studied by quenching techniques. Such research techniques as polarized light-microscopy and so on can be extremely fruitful. On the other hand, direct observation of phenomena at reaction temperatures may yield more easily interpretable or more relevant results. Line shape of NMR corresponding to mobility of molecule and/or segment in coal and tar pitch have been measured at the temperature range of mesophase formation. This paper deals with observation of resolved NMR spectra corresponding to aromatic and aliphatic protons at high temperatures in a tar pitch.

51040 Coal alkylation reaction: the characteristics of the alkylation reactions and products. Alemany, L.B.; Handy, C.I.; Stock, L.M. (Univ. of Chicago, IL). Contract EF-77-S-02-4227. *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **24**: No. 1, 156-165(1979). (CONF-790415—P2).

From 177. national meeting of the American Chemical Society; Honolulu, HI, USA (1 Apr 1979).

Sternberg and his associates found that the treatment of many coals with alkali metals in the presence of electron transfer agents formed polyanions which could be akylated to form compounds which were soluble in common organic solvents including heptane and benzene. More recently, we discussed the proton and carbon nmr spectra of typical gpc fractions of polybutylated Illinois No. 6 coal. This work revealed that there were significant differences in these fractions with variations in the degree of aromaticity, the ratio of C-butylation to O-butylation, the extent of butylation on aliphatic and aromatic carbon atoms, and the amount of carbonyl and vinyl derivatives. In addition, the low molecular weight fractions contained paraffinic hydrocarbons which presumably were liberated as the coal matrix collapsed. The results are compatible with the essential features of the reaction process proposed by Sternberg and his associates. He suggested that the electron transfer agent, naphthalene, transfers electrons from the metal to molecular fragments in the coal. Under these conditions, the aromatic molecules of the coal are reduced, and the basic anions produced under the experimental conditions react with acidic hydrogen atoms to yield aryloxides and stable carbanions. Ether cleavage and elimination reactions also occur under these experimental conditions. In addition, carbon—carbon bond cleavage reactions take place. The rich chemistry of the coal polyanion and the presumably close relationship between the structures of the coal polyanion and the initial coal molecules prompted us to study the reaction conditions and the reaction products carefully and then to examine the reaction of the coal polyanion with 90%-enriched butyl iodide-1-C-13. The results are described.

51041 Chemical structures and reactivities of coal as an organic natural product. Collins, C.J.; Hombach, H.P.; Benjamin, B.M.; Roark, W.H.; Maxwell, B.; Raaen, V.F. (Oak Ridge National Lab., TN). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **24**: No. 1, 191-196(1979). (CONF-790415—P2).

From 177. national meeting of the American Chemical Society; Honolulu, HI, USA (1 Apr 1979).

Based on the results of experiments conducted with labelled model compounds, including tetralin, and with Illinois No. 6 coal, it was concluded that the role of tetralin during coal conversion is (1) to act as a dispersion vehicle; (2) to supply hydrogen radicals, when needed, to trap coal radicals; and (3) in a very minor way to undergo intermolecular reaction with the coal through making and breaking of C—C (and possibly other) bonds. Two chemical reactions for solubilizing coals which have received much attention in recent

years are: (1) the Friedel Crafts reaction and reductions, either with lithium in suitable solvents, or electrolytically with lithium salts in ethylenediamine. Part of the interest in these reactions is undoubtedly due to the fact that they can be carried out at low temperatures. The chemical changes effected during coal reductions are usually considered to be breakage of ether and thioether linkages, as well as reduction of aromatic nuclei. Alkyl groups are not affected. The Birch—Hueckel reaction of aromatic rings to cyclic olefins is well known. It was recently reported that the use of NaK in mixed ethers as a coal reductant cleaves the alkyl linking groups between aromatic moieties, and results in an increase in the number of methyl groups in the reduced product. Oxidation studies have indicated a high frequency of ethylene connecting links in some bituminous coals. We therefore carried out the reduction of three model compounds using glycol ethers as the solvent. The compounds chosen were diphenyl-methane, bibenzyl, and 1,3-diphenylpropane. Of the three compounds, diphenylmethane exhibited some, and bibenzyl exhibited considerable C—C splitting in only 20 minutes, whereas 1,3-diphenylpropane was stable except for traces of toluene and ethylbenzene (when quenched with propanol-2).

51042 **Effect of reagent access in coal reactivity.** Larsen, J.W.; Choudhury, P.; Greene, T.; Kuemmerle, E.W. (Oak Ridge National Lab., TN). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **24**: No. 1, 197-202(1979). (CONF-790415—P2).

From 177. national meeting of the American Chemical Society; Honolulu, HI, USA (1 Apr 1979).

Bituminous coals contain cross-linked, three dimensional macromolecular networks. Perhaps the best evidence for this comes from experiments in which the coal is swollen by solvents. The weight increase in several coals which have been exhaustively extracted with pyridine is shown in a table. These coals can be swollen to about twice their original volume by absorbing solvent. The solvent-coal interactions responsible for this inhibition are strong enough so that if the coal molecules were not covalently linked together, they would dissolve. The observed behavior is characteristic of a cross-linked macromolecular network. Coal is a highly porous, insoluble material. An attacking reagent has access to those parts of the surface of the coal which form the walls of the pores into which it can diffuse. Any solvent which expands the pore structure will enhance a coal's reactivity by increasing the surface area accessable to the reagents. One limitation on coal reactivity is the ability of reagents to penetrate the pore structure. However, even ready penetration of the pores only gives access to the surface of the coal. For complete reaction, the reagent must diffuse into the coal network and penetrate to the bonds or groups with which it will react. It would seem that this diffusion process is likely to be very slow, and indeed may limit not only the rate of reaction but also the number of groups which ultimately react. Some examples of access limited reactions are given.

51043 **Ultrafine structure of coal determined by electron microscopy.** Harris, L.A.; Yust, C.S. (Oak Ridge National Labs., TN). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **24**: No. 1, 210-217(1979). (CONF-790415—P2).

From 177. national meeting of the American Chemical Society; Honolulu, HI, USA (1 Apr 1979).

The present paper is one of a series in which electron microscope analyses including transmission, scanning transmission, and scanning reflection methods have been employed in examining bituminous coals. These techniques have the advantage of revealing the microstructures of coal at magnifications substantially greater than that available with light microscopy. Consequently, a more detailed direct observation of the pores and submicron minerals within the coal may be obtained. The shape and size of pores in two high volatile bitumous coals of differing lithotypes have been directly observed by means of transmission electron microscopy (TEM). The distribution of the porosity with respect to their maceral associations were ascertained as were the sizes and distributions of the micro minerals. The use of stereo pairs reveals the interconnectivity of the pores in micro volumes of the macerals indicating a high degree of permeability within those regions. The finest porosity was observed in vitrinite fragments of both coals and ranged in size from under 2 nm to 20 nm in diameter, with the majority in the smaller end of the size range. On the other hand, inertinite appears to be the most porous maceral and typically contains a broad range of pores from 5 through 50 nm. Much of the inertinite is granular material varying from fine to coarse grained particles with the former corresponding to micrinite. Finally, the least porous maceral is exinite which generally appears as a featureless material except for the presence of irregular and tubular pores thought to be initiated by the catalytic action of minerals. The intimate relationship between exinite and inertinite, such as exists in durains where the inertinite contains large amounts of fine mineral matter, may therefore promote the generation of porosity in exinites.

51044 **Investigation of the structural type of fossil coal pores according to their gas capacity.** Tsintsadze, I.D. *Soobshch. Akad. Nauk Gruz. SSR;* **93**: No. 2, 413-416(1979). (In Russian).

It is shown that fossil coal pores belong to the first and second structural types. Estimation of coal porosity is recommended regarding the second structural type maximal pore volume value. Considerable specific surface of transient pores in long-flame coals of the Tkibuli—Shaori coalfield is shown, and the possibility of volumetric gas filling of the pores as well as polymolecular gas adsorption inferred.

WASTE MANAGEMENT

REFER ALSO TO CITATION(S) 50931, 50933, 50983, 51053, 51086, 51087, 51088, 51089, 51425, 51426, 51877, 52145, 52227

51045 (CONF-7606131—, pp 239-246) **Impediments to the utilization of flue-gas desulfurization systems.** Carlton, D.M.; Hargrove, O.W. (Radian Corp., Austin, TX). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

The combustion of Gulf Coast lignite will require the utilization of sulfur dioxide emissions-control technology. Given the present status of technology, flue-gas desulfurization is virtually the only viable approach for meeting this requirement. The controversy surrounding this technology is well known, and this paper is devoted to an examination of the principal issues in this controversy. The spectacular early falures are reviewed, as are such topics as the chemical nature of this technology in an industry not geared to chemical technology, the uncertainty surrounding the need for implementation of flue-gas-cleaning processes in terms of demonstrable adverse health effects, and the question of system reliability. Specifically with respect to reliability, data are presented which contrast the early experience with this technology with more recent experience. A summary of the present technical and political aspects of flue-gas cleaning is presented.

51046 (IMMR—32-M4-77) **Proceedings of third Kentucky coal refuse disposal and utilization seminar.** Rose, J.G. (ed.). (Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research). Dec 1977. 125p. (CONF-7705131—). College of Engr., Univ. of Kentucky, Lexington, KY.

From 3. coal refuse disposal and utilization seminar; Lexington, KY, USA (11 May 1977).

The Third Kentucky Coal Refuse Disposal and Utilization Seminar was held May 11—12, 1977, at the Hospitality Motor Inn in Lexington, Kentucky. Thirteen papers from the proceedings have been entered individually into EDB and ERA. One other had been entered previously from other sources. (LTN)

51047 (IMMR—32-M4-77, pp 79-82) **Aluminum from coal wastes?.** Hudson, L.K. (Alcoa Technical Center, Alcoa Center, PA). Dec 1977.

From 3. coal refuse disposal and utilization seminar; Lexington, KY, USA (11 May 1977).

The author is generally pessimistic about using mining or washery coal wastes or fly ash to recover aluminum as cheap as recovering it from bauxite (even though the price of bauxite has been artificially raised by the cartel). One possible exception is where washery wastes of 4000 Btu per lb, 30% alumina in the ash, and with no economic value, exist adjacent to supplies of limestone and perhaps some clay. (LTN)

51048 (IMMR—32-M4-77, pp 89-95) **Potential economics of the recovery of trace elements in coal refuse.** Katell, S. (West Virginia Univ., Morgantown). Dec 1977.

From 3. coal refuse disposal and utilization seminar; Lexington, KY, USA (11 May 1977).

51049 (IMMR—32-M4-77, pp 97-101) **Distribution of aluminum in shales associated with the major economic coal seams of Eastern Kentucky.** Robl, T.L.; Bland, A.E. (Univ. of Kentucky, Lexington). Dec 1977.

From 3. coal refuse disposal and utilization seminar; Lexington, KY, USA (11 May 1977).

Refuse examined from Eastern Kentucky was found to have a consistent chemical character (and hence predictability) with regard to the major coal seams, with Al_2O_3 concentrations falling into a range of 21 to 27 percent. The exception to this was the Hazard No. 4 refuse, with a much higher Al_2O_3 content (33 to 38%) due to the presence of an extensive flint clay splint of volcanic origin. The Western Kentucky refuse was found to be significantly lower in Al_2O_3, being more siliceous and having a large pyrite content. Eastern Kentucky refuse has potential as an alumina source if an acid extraction process is used for processing, since all of the Eastern

refuse is found to be above the minimum Al_2O_3 level (in acid leachable form) required. The refuse does not show a potential as an ore for an alkaline process, since only the Hazard No. 4 refuse meets the minimum Al_2O_3 requirements, and large quantities of pure limestone required for these processes are not readily available in the Appalachian Coal Basin. The Western Kentucky basin does not show promise as an alumina source due to its low Al_2O_3 content. In addition to meeting the basic compositional requirements for acid processing, the Eastern refuse has several other attributes with regard to material cost, energy requirements and composition, which enhance its attractiveness.

51050 (IMMR—32-M4-77, pp 103-109) **Sources of Canadian non-bauxite alumina.** Winer, A.A. (Canada Centre for Mineral and Energy Technology, Ottawa). Dec 1977.

From 3. coal refuse disposal and utilization seminar; Lexington, KY, USA (11 May 1977).

The objective of the CANMET alumina project is to investigate domestic non-bauxite sources of alumina and their treatment to gain expertise in order to advise government on technical matters related to this subject. The identification of potential indigenous alumina-bearing materials has been initiated, as well as experimental laboratory investigations of selected non-bauxite materials. Anorthosite, clays and shales, coal washing rejects, underclays, fly ash, and nepheline syenite are being examined. Anorthosite appears to have greatest potential because it is present in large quantity and is of reasonable quality (26 to 28% Al_2O_3). Occurrences of materials and typical analyses are noted. Current research studies at CANMET and proposed future work are briefly described.

51051 (IS—4655, pp 74-90) **Direct utilization: recovery of minerals from coal fly ash.** Burnet, G.; Murtha, M. May 1979.

In Fossil Energy Program. Technical progress report, October 1—December 31, 1978. I. Mining Research and Development-Coal Preparation and Analysis. II. Advanced Research and Technology Development.

Developmental research on two methods for recovering minerals from power plant fly ash was continued. The product recovery step and the recycle circuit for the lime-soda sinter process were investigated, as were the atomistic mechanisms of the sintering reactions. A reaction system has been assembled for the high-temperature gas chlorination (HiChlor) process which will accommodate high gas flow rates. The lime-soda sinter process was tested for two fly ashes from West Virginia coals. The correlation developed for the process was used to predict a sinter mixture composition for each fly ash which gave a high percentage alumina recovery. Analyses of raw sinter mixtures, sintered materials, and extracted sinter residues were used to determine soda losses during sintering and the soda remaining in the extracted residue. Tests to measure the silica dissolved during extraction and the amount which precipitates with the aluminum hydroxide sowed that electrolytic cell grade alumina is obtained. In the HiChlor process, a small reactor has been constructed for passage of gas downward through a fixed bed of ash and carbon for chlorination at high gas flow rates. The downward flow provides sufficient chlorine for reaction without ash entrainment in the gaseous products. A flow plan was prepared for processing of the fly ash, purification of the products, and development of the recycle circuits. A cost estimation and economic evaluation were completed for a plant processing 6,000 tons of fly ash daily. An 8.4% return was obtained on an investment of 101 million dollars. Research continued on methods to extract iron from coal fly ash in a form suitable for use by the steel industry, and to convert coal refuse to a high-iron content material.

51052 **Geotechnical practice for disposal of solid waste materials.** New York, NY; American Society of Civil Engineers (1977). 885p. (CONF-7706158—). $24.00.

From Conference on geotechnical practices for disposal of solid waste materials; Ann Arbor, MI, USA (13 Jun 1977).

The conference on geotechnical practice for disposal of solid waste materials was held June 13—15, 1977, at the University of Michigan, Ann Arbor, Michigan, as a specialty conference of the Geotechnical Engineering Division, ASCE. It was cosponsored by Michigan Section, ASCE and the Department of Civil Engineering, Extension Service, the University of Michigan. Seventeen papers from the proceedings mostly related to the disposal of mineral works from coal mining or coal preparation and the disposal of ashes, fly ash and scrubber sludges, have been entered individually into the data base. (LTN)

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 50963, 50964, 50995, 51003, 51062, 51070, 51074, 51098, 51100

51053 (ANL/EES-TM—21) **Sampling and sample handling procedures for priority pollutants in surface coal mining wastewaters.** Hayden, R.S.; Johnson, D.O.; Henricks, J.D. (Georgia Univ., Athens (USA); Argonne National Lab., IL (USA)). Mar 1979. Contract W-31-109-ENG-38. 28p. P 03/MF A01.

The report describes the procedures used by Argonne National Laboratory to sample surface coal mine effluents in order to obtain field and laboratory data on 110 organic compounds or classes of compounds and 14 metals and minerals that are known as priority pollutants, plus 5-day biochemical oxygen demand (BOD_5), total organic carbon (TOC), chemical oxygen demand (COD), total dissolved solids (TDS), and total suspended solids (TSS). Included are directions for preparation of sampling containers and equipment, methods of sampling and sample preservation, and field and laboratory protocols, including chain-of-custody procedures. Actual analytical procedures are not described, but their sources are referenced.

51054 (CONF-790630—, pp 281-294) **Organic groundwater contaminants from UCG.** Mattox, C.F.; Humenick, M.J. (Univ. of Texas, Austin). May 1979.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

The purpose of this research is to identify and quantify the organic compounds that could contaminate groundwaters in the vicinity of in-situ gasification of Texas lignite. Field samples of groundwater and above ground condensate and tar from two sites in Texas were analyzed by gas chromatography-mass spectrometry (GC—MS). The extent of groundwater contamination was found to be a strong function of the water solubility of the organics. Phenolic compounds such as phenol, indanol, naphthol, and other alkyl derivatives comprised most of the organics in the burn cavity waters. Polynuclear aromatic hydrocarbons (PNA) were present in very low concentrations consistent with their solubilities. PNA's of up to five condensed rings, including benzo[a]pyrene, were found in the ppB levels. Based on limited sampling, water quality has appeared to improve over a one year period after gasification operations were completed at a field test site.

51055 (CONF-7606131—, pp 199-208) **Land reclamation in Texas - an opportunity.** White, R.L. (Texas Utilities Generating Co., Fairfield). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

Surface mining for lignite is increasing in order to meet Texas' energy needs. But the strip-mining recovery technique has historically aroused a negative reaction in the public because of lands left unreclaimed and nonproductive. Texas lignite lies in a northeast-to-southwest band across the State, but the deposits of commercial importance, recoverable by surface mining, lie principally in East Texas. This low-rank coal occurs in areas where the climatic and physiographic conditions favor land reclamation. Through research, planning, and application, Texas Utilities Generating Company has established a successful land-reclamation program whereby environmental effects are minimized and the land's productivity is restored. Although problems occur periodically, they have been overcome through utilization of the benign factors naturally afforded by the area as well as corporate commitment. Land reclamation is an opportunity that should be approached on an objective, informed basis.

51056 (CONF-7606131—, pp 209-217) **Physical and chemical properties of lignite spoil material as it influences successful revegetation.** Hons, F.M.; Askenasy, P.E.; Hossner, L.R.; Whiteley, E.L. (Texas A & M Univ., College Station). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

Lignite surface-mine spoils at Fairfield, Texas, contain more than adequate amounts of calcium, potassium, and magnesium to sustain plant growth, but nitrogen and phosphorus must be added in order to obtain proper revegetation. Forage grasses and legumes including NK-37, coastal Bermudagrass, Bahiagrass, Kleingrass, alfalfa, Uchi arrowleaf, and crimson clovers have been successfully established on the reclaimed soils. Corn, grain sorghum, and soybeans have also been established, with grain sorghum being the most promising of the row crops. The sulfate concentration in the mined soils increases with time after mining due to the oxidation of pyritic minerals near the soil surface. Pyrite oxidation results in increased soil acidity. Biological oxidation of NH_4^+ NO_3^- via the nitrification pathway is restricted in these mined soils, thereby affecting the use and efficiency of ammonium forms of fertilizer.

51057 (CONF-7606131—, pp 218-227) **Hydrogeologic factors which influence the reclamation of lignite mines.** Pennington, D. (Richard Cowan & Associates, Quakertown, PA). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

Large lignite reserves and the resultant rapid expansion of mining activities in response to energy needs increase the potential for contamination of surface waters and ground wters in the Gulf lignite province. Reclamation of these new mine areas is complicated by the variations in climate of the region. Lignite deposits of Texas, in particular, are emphasized. Surface mining can intercept aquifers and disrupt the ground-water flow pattern. The magnitude of this disruption is dependent on the lateral extent of the aquifer and whether the aquifer is a major or minor source of water. The hydrologic impact of mining activities in semiarid to arid environments and the hydrologic changes associated with surface mining are related in this paper to reclamation. Factors discussed include the hydrologic effects of shaping spoil piles, movement of water in underground mines, subsidence fractures, and water requirements for revegetation. Reclamation also can cause blocking or disruption of the ground-water system. Techniques to minimize this disruption are discussed including the construction of artificial aquifers.

51058 (CONF-7606131—, pp 228-238) **Water for lignite development in Texas.** Hoffman, H.W. Jr. (Texas Water Development Board, Austin). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

Water requirements associated with lignite utilization and conversion may be a major factor limiting full potential development of lignite resources in Texas. The purpose of this paper is to demonstrate the magnitude of these water requirements and the impact water availability can have on the potential development and utilization of this resource in Texas.

51059 (DOE/ERD—0024) **Coal extraction and preparation technology.** (Department of Energy, Washington, DC (USA)). Jul 1979. 55p. P 04/MF A01.

The evolving extraction, preparation, and transportation techniques receiving Department of Energy (DOE) support do not create new or substantially different environmental impacts from those of both previous and contemporaroy techniques. As the coal mining industry expands into new geographic regions, new and different environmental problems can be expected. For example, surface mining in western regions of the United States encounters special revegetation problems in arid environments. Impacts on hydrologic resources also require particular attention because the mined coal seam is frequently an important stratum for recharging aquifers. Unique environmental problems require research and assessment. The purpose of this Environmental Readiness Document is to assess the environmental impacts associated with the current and evolving industry and examine the environmental implications of increased coal utilization. Existing data and the collective judgment of Office of Environment (EV) scientists indicate that expansion in coal regions will be restricted physically by lack of resources, such as water, and institutionally by environmental protection laws and regulations. Restrictions will vary with regions; many will be extremely site specific. For instance, lack of sufficient water for land reclamation, solid waste disposal, and slurry pipelines will be especially significant concerns in arid regions of the southwest and northern Great Plains. The extent of restrictions will be governed by Federal, State, and local legislation and regulations concerning water use, allowable effluent concentrations, extent of required land reclamation, coal severence taxes, and protected wildlife habitat.Definitions of unpromulgated regulations or redefinition of preliminary regulations and guidelines resulting from Federal legislation will have a major impact on coal extraction, beneficiation, and transportation.

51060 (DOE/ET/2880—1) **Possible future environmental issues for fossil fuel technologies. Final report.** Attaway, L.D. (Flow Resources Corp., San Rafael, CA (USA)). Jul 1979. Contract ET-78-C-01-2880. 245p. P 11/MF A01.

The work reported here was carried out for the Department of Energy's Office of Fossil Energy to identify and assess 15 to 20 major environmental issues likely to affect the implementation of fossil energy technologies between 1985 and 2000. The energy technologies specifically addressed are: oil recovery and processing; gas recovery and processing; coal liquefaction; coal gasification (surface); in situ coal gasification; direct coal combustion; advanced power systems; magnetohydrodynamics; surface oil shale retorting; and true and modified in situ oil shale retorting. Environmental analysis of these technologies included, in addition to the main processing steps, the complete fuel cycle from resource extraction to end use. The 16 environmental issues identified as those most likely for future regulatory actions and the main features of, and the possible regulatory actions associated with, each are as follows: disposal of solid waste from coal conversion and combustion technologies; water consumption by coal and oil shale conversion technologies; siting of coal conversion facilities; the carbon dioxide greenhouse effect; emission of polycyclic organic matter (POM); impacts of outer continental shelf (OCS) oil development; emission of trace elements; groundwater contamination; liquefied natural gas (LNG), safety and environmental factors; underground coal mining - health and safety; fugitive emissions from coal gasification and liquefaction - health and safety; boomtown effects; emission of fine particulates from coal, oil and oil shale technologies; emission of radioactivity from the mining and conversion of coal; emission of nitrogn oxides; and land disturbance from surface mining. (LTN)

RESERVES AND EXPLORATION

REFER ALSO TO CITATION(S) 51073

51061 (CONF-790630—, pp 381-400) **Resource and development potential maps of Federal coal.** Wayland, R.G. (US Geological Survey, Reston, VA). May 1979.

From 5. underground coal conversion symposium; Alexandria, VA, USA (18 Jun 1979).

Now available to anyone considering underground conversion as well as conventional mining of coal deposits owned by the Federal Government are the first 100 of a comprehensive series of about 1400 coal resource occurrence and coal development potential (CRO/CDP) quadrangle map sets. Under US Geological Survey supervision, contractors are compiling existing publicly available data in a standard format consisting of multiple plates and a text report for each 7 1/2-minute quadrangle with known Federal coal lands. These map sets can be purchased at 1:24,000 scale or in microfiche from the US Geological Survey Open File Services Section in Denver. For each coal bed meeting minimum thickness and depth standards, the maps present structure contours and both coal and overburden isopachs. For a quadrangle with seven qualifying coal beds, about 40 plates would be compiled. Measured, indicated, and inferred reserve base tonnages and estimates of reserve tonnages are given for unleased Federal coal. The relative potential for development is indicated for land-use planning purposes for areas as small as 40 acres. Many of the coal beds on Federal lands are thick and deep, inviting underground conversion.

51062 (CONF-7606131—) **Proceedings Gulf Coast Lignite Conference: geology, utilization, and environmental aspects. Report of investigations No. 90.** Kaiser, W.R. (ed.). (Texas Univ., Austin (USA). Bureau of Economic Geology). 1978. Contract EX-76-X-01-7615. 283p. NTIS PC A13/MF A01.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

The Gulf Coast Lignite Conference: geology, utilization, and environmental aspects was sponsored by Bureau of Economic Geology, The University of Texas at Austin; U.S. Energy Research and Development Administration; and the National Science Foundation Research Applied to National Needs (RANN). The conference was held June 2, 3, and 4, 1976, at Austin, Texas. Twenty-nine papers from the proceedings have been entered individually into EDB and ERA. (LTN)

51063 (CONF-7606131—, pp 5-20) **Environments of peat accumulation-coastal Louisiana.** Frazier, D.E.; Osanik, A.; Elsik, W.C. (Exxon Co., Houston, TX). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

The principal peat-forming environments in coastal Louisiana are the inland fresh-water cypress-gum swampland and the peripheral coastal marshland where the marsh flora is zoned coastward from fresh-water to brackish to saline-tolerant grasses and sedges. The broad floodbasins in the centralized alluvial valley diminish in size and increase in number downstream caused by the Mississippi River trunk stream bifurcating into major distributary-channel networks which enclose smaller interdistributary basins. The inner swampland terminates basinward within a short distance along the flanks of the distributary levee systems, and the coastward widening interdistributary areas transform into the slowly subsiding peripheral coastal marshlands. Additional peat-forming environments exist in western coastal Louisiana on the contiguous marshes of the chenier plain between relict beaches and in eastern Louisiana in small saline mangrove swamps on the washover (landward) side of the Chandeleur Islands. Thicknesses and radiocarbon dates of peats from more than a thousand shallow borings verify that peats have been forming in these environments for the past several thousand years. The thickest peats encountered are in the inland swamps and are attributed to environmental stability. Subsiding marshes, genetically related to thin, overlapped delta lobes, form repetitive layers of peat in the peripheral areas. Each thick inland swamp peat, therefore, may be time correlative with several coastal marsh peats. These thick

swamp peats make the inland swampland the most prospective ancient coal-forming environment.

51064 (CONF-7606131—, pp 21-32) **Palynology of Gulf Coast lignites: the stratigraphic framework and depositional environments.** Elsik, W.C. (Exxon Co., Houston, TX). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

Economic deposits of lignite occur in Texas in the Calvert Bluff Formation, Wilcox Group (Paleocene - early Eocene); the Yegua Formation, uppermost Claiborne Group (late middle Eocene); and the Manning Formation, Jackson Group (late Eocene). Lignites occur in these and other formations of the Wilcox, Claiborne, and Jackson Groups throughout the Gulf Coast and reflect various depositional settings. The general nonmarine nature of the lignite-enclosing sediments requires correlation with nonmarine fossils. Pollen and spores are well suited for this purpose. A combination of species occurrence and relative abundance techniques allows for the differentiation of Wilcox from other sediments on the ubiquitous presence of Thomsonipollis. Allowing for changing conditions with time, the lower Tertiary lignites can be characterized as follows: Calvert Bluff lignites were sourced by a variety of trees mainly of the Betulaceae—Myricaceae, Nyssa type and/or the extinct plant represented by Thomsonipollis. Yegua and Manning lignites yield an abundance of pollen of the trees of Engelhardia and Nyssa. Yegua lignites may also carry sparse to common pollen of Amanoa. Manning lignites may yield an abundance of the extinct Pollenites laesius. All lignites examined to date lack the characteristic abundance of Taxodium seen in Mississippi delta swamp peats. Accessory palynomorphs of shrubs and herbaceous plants present in all the lignites include a variety of fern spores. The pollen of grasses is absent from most early Tertiary marsh sediments. Fern spores and pollen of the dominant tree vegetation may also occur in the marsh lignites. Manning marsh lignites yield an abundance of finely divided amorphous organic material as contrasted to structured (unaltered) woody tissue in the Yegua and Wilcox swamp lignites.

51065 (CONF-7606131—, pp 33-53) **Depositional systems in the Wilcox group (Eocene) of East-Central Texas and the occurrence of lignite.** Kaiser, W.R. (Univ. of Texas, Austin). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

Between the Colorado and Trinity Rivers, the Wilcox Group (lower Eocene) is divided into three formations; upsection they are the Hooper, Simsboro, and Calvert Bluff. The most important commercial lignite deposits occur in the Calvert Bluff Formation. Lignite of lesser importance occurs in the upper Hooper Formation. The Calvert Bluff is a dip-oriented channel system 500 to 2,000 ft thick, dipping southeast at 1/2 to 2^0. Major rivers flowed from the northwest to the southeast. Updip is a straight or slightly dendritic channel geometry. This geometry, based on analogy with modern deltas, is representative of the transition between the bifurcating distributary channel facies of the lower delta plain and the dendritic fluvial channel facies of the high allurial plain. The outcrop is positioned at the transition zone between the lower alluvial plain and the upper delta plain. Southward there is a convergence of depositional and structural strike. In the deep subsurface is a bifurcating channel geometry. Lignite in the Calvert Bluff occupies an interchannel position. In interchannel basins, fresh-water swamps and marshes were the sites of greatest organic accumulation. Peat is best developed far from the contaminating influence of active channels and inland from the destructive effects of the Gulf, at the junction of the delta and alluvial plains. Infilling of the basins by crevassing and overbank flooding generates coarsening-upward sediment sequences. An ideal Calvert Bluff coarsening-upward sequence is approximately 15m thick and begins with lignite, then passes into clay, mud, interlaminated mud and very fine-grained sand, and finally beds of flat-bedded fine sand. Exploratory drilling in the Calvert Bluff should concentrate on the interchannel areas (low sand-percent areas) coincident with a high lignite count. All the major near-surface deposits can be identified using the model outlined.

51066 (CONF-7606131—, pp 54-58) **Tertiary lignites of Mississippi.** Williamson, D.R. (South Louisiana Production Co., Lafayette). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

Lignite is present in the Tertiary sediments of Mississippi in potential commercial quantity and quality. The Mississippi Tertiary lignites are found principally in two geologic horizons of the Eocene series - the Wilcox Group and the Claiborne Group. The sediments of the Wilcox and Claiborne Groups crop out in narrow arcuate bands through north-central and east-central Mississippi. The area of outcrop occupies all or portions of 33 of the State's 82 counties and covers an area of approximately 12,578 square miles. The lignites are present, at strippable depths, as tabular, discontinuous, irregularly shaped deposits overlain by unconsolidated sands, silts, and clays. Lignite seam thicknesses vary from a few inches along the margins of deposits up to 10 to 12 ft at the center of really restricted basins. Lignite seams 4 to 7 ft in thickness are more common. The quality of Mississippi lignites is generally good. Moisture content is high, varying from 40 to 45 percent; sulfur content is usually less than 1 percent in cored samples; ash content is variable, but averages about 16 percent. Mississippi lignite samples generally vary from 4,800 to 5,500 Btu/lb on an as-received basis. Lignite apparently has a future in the economic growth of Mississippi as a potential energy source. To date at least six energy-producing companies have conducted lignite exploration programs in Mississippi, concentrating on the Wilcox trend. Since mid-1973 approximately 450,000 acres have been leased for lignite in Mississippi.

51067 (CONF-7606131—, pp 59-65) **Lignite resources of the Alabama-Tombigbee Rivers Region, Alabama.** Self, D.M. (Consolidation Coal Co., Meridian, MS). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

The lignite resources of the Alabama—Tombigee Rivers Region of southwest Alabama exceed 4.7 billion short tons (4.3 billion tonnes). Near-surface deposits having economic potential occur in the Oak Hill Member of the Naheola Formation (Paleocene) and the upper unnamed member of the Tuscahoma Formation (lower Eocene). Demonstrated reserves in the near-surface amount to approximately 562 million short tons (510.9 million tonnes). The near-surface lignite in the Oak Hill Member generally occurs as a single tabular bed which ranges from 1 to 14 ft (0.3 to 4.3 m) in thickness. Moisture and sulfur content are high; however, ash content is low, and the calorific value may exceed 11,200 Btu/lb (6,222 kcal/kg) on a moisture-free basis. The lignite of the Tuscahoma Formation occurs in from one to six lenticular beds and is generally inferior to the Oak Hill lignite. The ash content is very high, and the calorific value is correspondingly low. Deep-basin deposits occur in the Midway and Wilcox Groups; however, only the Midway lignites appear to have economic potential. Demonstrated and inferred resources in deep-basin deposits total over 4.1 billion short tons (3.7 billion tonnes). The lignite of the Midway Group occurs in one to three beds which are apparently equivalent to the near-surface lignite of the Oak Hill Member.

51068 (CONF-7606131—, pp 66-78) **Louisiana lignite.** Roland, H.L. Jr. (Louisiana Geological Survey, Baton Rouge). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

Some of the lignites in northwestern Louisiana have been mapped and evaluated by the Louisiana Geological Survey under the auspices of the Division of Natural Resources and Energy, Louisiana Department of Conservation. Two areas were investigated: one in southeastern De Soto Parish, the other in west-central Sabine Parish. The most significant result of these surveys was determining that the Chemard Lake lignite lentil has consistent thickness and continuity over a rather large area in southeast De Soto Parish and contains estimated reserves of at least 546 million tons of lignite. The lignite in Sabine Parish is not as thick or as consistent as that in De Soto Parish. The area mapped contains approximately 50 million tons of lignite.

51069 (CONF-7606131—, pp 79-83) **Geology of the San Miguel lignite deposit (Atascosa and McMullen counties, Texas).** McNulty, J.E. Jr. (Paul Weir Co., Chicago, IL). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

The San Miguel lignite deposit is named for outcrop exposures in San Miguel Creek in northern McMullen County. Authors have considered this lignite to be in the upper Yegua Formation or in the lower part of the Jackson group of the upper Eocene. The Yegua—Jackson contact has not been established in this area. Extensive drilling in 1970 and 1973 defined the quantity and quality of the lignite and determined the feasibility of economic recovery by surface-mining methods. The San Miguel lignite is a complex bed, that is, one composed of benches of lignite separated by partings of clay and carbonaceous shale. This deposit is considered part of the Jackson South Texas lagoonal coastal-plain system. The lagoonal depositional environment is reflected in the quality of the lignite, which affected the design parameters of the proposed fuel utilization. Proven reserves of this deposit are dedicated to the proposed San Miguel Plant of Brazos Electric Power Cooperative and South Texas Electric Cooperative.

51070 (CONF-7606131—, pp 189-198) **Environmental geology of the East Texas lignite belt.** Henry, C.D.; Kastning, E.H. (Univ. of Texas, Austin). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

The dramatic increase in lignite mining of the past few years is expected to continue in Texas. Surface mining of coal in other parts of the United States has created severe environmental problems. Careful planning of future mining to avoid environmental degradation will require an understanding of how mining can affect the environment and a thorough inventory of land and water resources which could be affected. To provide basic planning data the Bureau of Economic Geology has mapped the environmental geology of the Wilcox-Carrizo outcrop belt between the Colorado and Trinity Rivers. Criteria for defining and mapping environmental geologic units are substrate, soil, biologic assemblage, geomorphology and geologic process. Three groups of units cover a majority of the lignite areas and are the most critical to mining. Sandy clays are the substrate in which most mining will occur and must be evaluated on their potential for reclamation. The sandy clays have been subdivided by soil associations to indicate a relative need for preservation of soils during mining. Flood-prone areas are hazardous for mining, could have ground-water-discharge problems, and have highly fertile soils requiring preservation. Sands are aquifer-recharge areas to the major aquifers of East Texas. Mining, which intersects sands, could have ground-water-discharge problems and could lead to pollution of the aquifers. The environmental geologic map (1) identifies problem areas for mining, (2) provides basic information for planning of reclamation, and (3) provides a regional framework for detailed studies at individual mine sites.

51071 Proceedings of the second symposium on the geology of Rocky Mountain coal, 1977. Hodgson, H.E. (ed.). Denver, CO; Colorado Geological Survey (1978). 228p. (CONF-7705175—). $5.00.

From 2. symposium on the geology of Rocky Mountain; Golden, CO, USA (9 May 1977).

The 1977 Symposium on the Geology of Rocky Mountain Coal was held May 9 and 10 on the campus of the Colorado School of Mines in Golden, Colorado. The 1977 Symposium was sponsored by the Colorado Geological Survey and the US Geological Survey. The 1977 Symposium consisted of four technical sessions: Depositional Models for Coal Exploration in the Rocky Mountain Cretaceous; Stratigraphy and Depositional Environments of Rocky Mountain Tertiary Coal Deposits; Depositional Models for Coal Exploration in non-Rocky Mountain Regions; and Application of Geology to Coal Mining and Coal Mine Planning. Several papers discuss geophysical survey and well logging techniques applied to the exploration of coal deposits and for mine planning. Fouteen papers have been entered individually into EDB and ERA. (LTN)

51072 Coal resources of Nebraska. Burchett, R.R. Lincoln, NE; Univ. of Nebraska (1977). 192p. (NP—23879).

Beds of subbituminous to bituminous coal in rocks of the Virgil Series of the Pennsylvanian System and beds of lignite in the Upper Cretaceous Series of the Cretaceous System crop out at several places in eastern Nebraska. Drift mines opened into some of these seams early in the state's history were short-lived, mostly because these beds are too thin to be worked economically. Several coals in the Des Moines Series of the Pennsylvanian System are deeply buried in southeastern Nebraska, and one deep-lying lignite bed of Tertiary age reportedly was encountered by drilling at Chadron, in Dawes County. Mining of these seams has not been attempted. In several small areas the outcropping coals are under less than 50 feet of overburden and thus probably could be strip-mined profitably. These locations are shown on maps, and estimates of reserves are given. Some of the coals that are too deeply buried to be mined possibly could be gasified in place. Analytical results for samples collected from coal outcrops indicate some rather high concentrations of elements that occur only in trace amounts in most rocks. Whether the fresh coal contains similarly high concentrations has not been determined.

MINING

REFER ALSO TO CITATION(S) 51053, 51055, 51056, 51057, 51059, 51062, 51070, 51099, 51100, 51873

51073 (CONF-7606131—, pp 84-86) **Technology and economics of mining Texas lignite.** Brummett, R.W. (John T. Boyd Co., Denver, CO); O'Donovan, J.D. 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

This paper covers the technology and economics of strip mining lignite in the Texas Gulf coastal area. The subject matter has been limited to current stripping methods applied to the present and future mining conditions in this region. Although relatively large-scale strip mining began in 1971, the mines developed today are located in the thicker and essentially single-seam deposits under shallow to intermediate overburden depths. The reserve areas currently being explored commonly contain thin multiple seams that are lenticular and deep. As such, their mining will pose different problems and certainly result in higher costs than those of the current operations.

51074 (CONF-7606131—, pp 87-92) **State of technology of deep multiseam mining in European open-cast mines.** Peretti, K.H. (Rheinbraun-Consulting GmbH; Koln, West Germany). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

Three factors are decisive for selective operation. The lifting mechanism of the bucket-wheel boom which permits lifting and lowering of the bucket wheel during the excavation and during the swivel or slewing operations. In this way the bucket wheel can be adjusted to the inclination of the layers during the excavation operation. Secondly, the arrangement of the operator's stand is coordinated with the cutting height. Therefore, it is possible for the operator to watch and control the excavating operation through the different layers. Then thirdly, the telescoping bridge which separates the excavator part from the loading part can be extended and retracted so that it is possible for the bucket-wheel excavator to cut above and below the conveyor-belt level. In this way, the excavation can be lifted and lowered and adjusted to certain seam conditions and work in selective operations. In our Rheinbraun mines we do not only use selective operation in coal seams with intermediate layers, but also in the respective overburden layers. Apart from the topsoil layer used for reclamation, gravel and sand layers are removed separate from the clay layers; gravel and sand is conveyed by belts to the lower sector and deposited for a drainage layer in the lowest part of the dump to provide for overall stability of the dump. Next, let me speak about the interdependence between the actual excavating output and height of slices when using bucket-wheel excavators in selective operation. The slide shows this interdependence with three bucket-wheel excavators of different capacities. So when choosing bucket-wheel excavators for selective operation, detailed planning considerations are necessary to adapt the desired capacity of the equipment to the geological conditions. The examples show that in mining relatively thin seams, the larger the equipment capacity, the larger the reduction in output. However, by increasing the slewing speed, the capacity decrease can be reduced.

51075 (DOE/EIA—0183/9) **Coal strike impact methodologies. Technical report.** Schnapp, R.M.; Wenger, R.S. (Department of Energy, Washington, DC (USA). Energy Information Administration). Dec 1978. 71p. P 04/MF A01.

This Technical Report presents the methodologies of two models used to evaluate the economic impacts ofthe 1977—1978 United Mine Workers of America coal strike. The first methodology, the Industrial Payrolls Model, was developed prior to the strike by the Office of Integrative Analysis. Because of sufficient inventories in the industrial sector, this model's usefulness became limited. The second methodology was developed in February 1978, when the strike was in its tenth week, by the Departments of Energy and Labor and the Council of Economic Advisors. A sample of the computer output of each of the models is included as well as the survey forms and detailed list of assumptions. The report also includes recommendations that further testing of the parameters be made of each model and planning for interagency agreements be made before the models are needed again during an energy disruption.

51076 (FE—1231-16) **Design optimization in underground coal systems. Sections 1—4. Interim report, January—March 1979.** Haycocks, C. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Mining and Minerals Engineering). Jun 1979. Contract EX-76-C-01-1231. 66p. P 04/MF A01.

Work continued on the longwall simulator with a more detailed examination of the potential for utilizing a roof characterization factor in the estimation of roof stability, both in the development entires as well as above the support line at the face. The proposed roof characterization factor, which is tentatively being incorporated at this time, is similar in general concept to that advanced by Terzaghi, 1946; Barton, 1974; and Bieniawski, 1976. The primary factors currently being utilized are strata thickness, moduli and interlayer relationships, joint densities continuities, surface characteristics and orientations, and strata strengths. The development of such an approach using a roof-characterization factor for laminated rocks has encountered some special problems, particularly that related to inter-strata loading in the immediate roof. This loading is a factor in roof stability in addition to joint density and rock properties. Currently an arbritary method of deciding which layers will load the underlying strata is being based upon the work developed using elastic analysis by Obert, Duvall and Merrill, 1960. The benefits of the roof characterization approach are a much more realistic evaluation of roof conditions, and therefore, a more accurate prediction of strata responses during underground mining. Work continued on the final report of the roof truss portion of the work. The report includes the theory, modeling method, experimental and

field data, and the analysis and correlation of the above, in addition to recommendations concerning efficient installation and usage of roof trusses. The development and maintenance of computer programs used in the work are also discussed in detail. (LTN)

51077 (FE—2468-38) **Review of the borehole hydraulic coal mining system. Final report on task oil.** Boyce, T.A. (Engineering Societies Commission on Energy, Inc., Washington, DC (USA)). Dec 1978. Contract EF-77-C-01-2468. 56p. P 04/MF A01.

As part of a coal mining R and D review task being undertaken by the Engineering Societies Commission on Energy, Inc., for the Department of Energy Fossil Energy Program, the borehole hydraulic mining system was selected for review. The borehole hydraulic coal mining system accesses the coal seam through a hole drilled in the overburden. The mining device is lowered through the hole into the coal seam where it fragments the coal with high-pressure water jets. The fragmented coal is pumped to the surface as a slurry by a jet pump located in the center of the mining device. The coal slurry is then injected into a slurry pipeline for transport to the preparation plant. The study included a technical assessment, an economic assessment, a comparison with other methods, and a review of regional applicability. Nominal cases for applications of the borehole method in both horizontal and near-vertical seams were analyzed. The borehole mining system results in recovery of approximately 45% of the coal in place. In horizontal seams, strip mining offers considerably lower cost for the same ratio of overburden to coal. In pitching seams, the scarcity of thick vertical seams limits the geographic applicability of the borehole method.

51078 (PB—288191) **Electromagnetic technique for locating boreholes. Report of investigations.** Sacks, H.K. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Mining and Safety Research Center). 1978. 19p. Y A02/MF A01.

The Bureau of Mines has developed hardware for electromagnetic (EM) detection and location of miners trapped in underground coal mines. This report describes a technique for using the developed equipment for locating uncased boreholes underground. Results of several field and laboratory experiments are described.

51079 **Roof fall hazards, and the machines that are reducing risks to miners.** *Mine Saf. Health;* 4: No. 3, 2-5(Jun 1979).

51080 **Map of licensed coal mines in Colorado as of June 1, 1978. Coal mine information.** Denver, CO; Colorado Geological Survey (1978). 1p.

This detailed map of licensed coal mines by counties in Colorado as of June 1, 1978, pinpoints the mine location, specifies the rank of coal mined and its use, and indicates the thickness of the formation, its production level, and the number of employees. The production status (producing or nonproducing presently) for each surface and underground mine is shown. The approximate outline of coal-bearing regions and railroad routes are indicated. (MCW)

TRANSPORT AND HANDLING

REFER ALSO TO CITATION(S) 50993, 51025, 51046, 51059

51081 (CONF-7606131—, pp 93-99) **Hydraulic transportation of lignite.** Shock, D.A. (Continental Oil Co., Ponca City, OK). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

The cost of transportation in producing and delivering a bulk product to its end use is one of the major items in the final cost. With the probability that the Gulf Coast lignite will be developed as a fuel in the near future, the various transport modes in coal mining are examined. The newer developments in the use of hydraulic transport are presented, and the possible application to lignite discussed.

51082 (FE—2475-22) **Developing/modifying coal grinding procedures and equipment to produce predictable size distributions during coal preparation. Quarterly progress report, April—June 1978.** Luckie, P.T. (Kennedy Van Saun Corp., Danville, PA (USA)). 15 Jul 1978. Contract EX-76-C-01-2475. 145p. P 07/MF A01.

The work centered on completing the final version of a paper which summarizes the coal in oil grinding, the development of the mathematical models to describe the size reduction devices and the completion of the mechanical property testing of the project coals. Benchmark tests on the air swept hammer mill were conducted. This system was found to be very sensitive to operating load. The hammer mill rpm is now being increased. Benchmark tests on the wet grinding system were started with emphasis on the effect of weight percent solids. Special tests to facilitate the mathematical model development of the air swept ball mill and ball and race mill were conducted.

51083 (IMMR—32-M4-77, pp 1-4) **State-of-the-art of coal cleaning and recent developments in equipment and circuits.** Killmeyer, R.P. Jr. (Bureau of Mines, Pittsburgh, PA). Dec 1977.

From 3. coal refuse disposal and utilization seminar; Lexington, KY, USA (11 May 1977).

The coal preparation state-of-the-art is changing rapidly in the United States today. The scope of this change and some of the new circuit and equipment innovations that have been recently introduced are described. The major emphasis is on reduction of sulfur and maximization of Btu recovery. The need for sulfur reduction stems from the enforcement of SO_2 emission standards, while high-Btu recovery becomes essential as a result of the increased value of coal as an energy source. The resulting irony spells out the challenge facing coal preparation today; how to economically produce increasing amounts of coal that satisfy the strict pollution standards. To meet this challenge, coal preparation practices are directed toward fine-size coal washing and dense-medium processes. A possible solution to the dual problems of environmental restrictions and maximum recovery is the highly-publicized Homer City multi-stream coal cleaning plant. The examples discussed in the paper show that there are innovations from all areas of coal preparation. The new equipment and techniques, more complex circuitry, and higher levels of control are all needed to insure that the demands of the coal market can be met economically.

51084 (IMMR—32-M4-77, pp 5-9) **Some economic aspects of coal preparation.** Symonds, D.F. (Birtley Engineering Corp., Salt Lake City, UT). Dec 1977.

From 3. coal refuse disposal and utilization seminar; Lexington, KY, USA (11 May 1977).

Recent changes in the coal industry are resulting in a new approach to coal preparation. Substantial long-term economic benefits can be gained if the owner spends a little more time and money on the front-end evaluation and design phase of the project. He must not only carefully examine the coal quality and its variability, but also factors such as plant availability, actual market requirements, and incentive/penalty considerations in his contract. The cheap off-the-shelf plant may, under certain circumstances, be ideal, but invariably long and even short-term advantages will result from studying each project on its own and tailoring the facility to its unique requirements.

51085 (IMMR—32-M4-77, pp 11-14) **Problems related to coal preparation plant design and construction.** West, T.W. (Dravo Corp., Pittsburgh, PA). Dec 1977.

From 3. coal refuse disposal and utilization seminar; Lexington, KY, USA (11 May 1977).

During the design and construction of a coal preparation facility, there are many items that can cause serious problems if not properly handled during the early stages. These problems can be a detriment to smooth owner/contractor relationships, maintenance schedules and budgets, and start-up. The purpose of this presentation is to identify many of the problems and to suggest steps that can be taken to reduce or eliminate their impact.

51086 (IMMR—32-M4-77, pp 15-18) **Pressure filtration technology in the coal industry.** Forster, H.W. (Passavant Corp., Birmingham, AL). Dec 1977.

From 3. coal refuse disposal and utilization seminar; Lexington, KY, USA (11 May 1977).

The pressure filter has been employed for approximately the past century in liquid/solids separation; it is the work horse in the chemical industry, and of late has been successfully employed in municipal sludge dewatering. The application of the pressure filter in the coal industry has been practiced for many years in Europe, and has recently received attention in this country. The pressure filter has been fully automated - minimizing labor - and units can be provided of sufficient size to handle today's capacities, and which produce filter cakes in excess of 75% solids, with filtrate suspended solids less than 100 parts per million.

51087 (IMMR—32-M4-77, pp 23-28) **Gob pile and slurry pond sediment beneficiation using the Otisca Process.** Keller, D.V. Jr. (Otisca Industries, Ltd., LaFayette, NY). Dec 1977.

From 3. coal refuse disposal and utilization seminar; Lexington, KY, USA (11 May 1977).

A discussion of the definition of coal gob and slurry pond sediment based on coal market price, washability and coal preparation costs indicates the desirability for lower preparation costs of finer coals. One solution to this problem is the Otisca Process which is discussed in detail relative to slack coal and slurry pond coal beneficiation.

51088 (IMMR—32-M4-77, pp 31-39) **Reprocessing of coal refuse for a second yield of steam coal.** Maneval, D.R. (Appalachian Regional Commission, Washington, DC). Dec 1977.

From 3. coal refuse disposal and utilization seminar; Lexington, KY, USA (11 May 1977).

The author discusses the case for refuse reprocessing and describes several case histories on this topic. There are millions of tons of coal refuse dispersed throughout Appalachia which contain recoverable coal. As both the price of mining and the cost of coal increase, the reprocessing of old banks becomes more attractive. Many established mining companies are inventorying and analyzing the refuse piles which they own. Certain old deposits are sufficiently high in carbon content that they are being loaded out and sold, with only minor scalping, for utility use. This is especially the practice with the culm banks that have resulted from earlier production of coking coal. In some cases, older banks are being rewashed to produce a marketable product for utility or industrial use. Reprocessing mine refuse also provides environmental and public image benefits. The removal of old refuse piles, followed by reprocessing and replacement of the secondary refuse, not only eliminates eyesores but can also provide needed land for industrial development.

51089 (IMMR—32-M4-77, pp 41-42) **Processing plant for the reclamation of coal.** Gay, L.T.; Batchelder, S. (Coal Purification Associates of Kentucky, Inc., Lexington). Dec 1977.

From 3. coal refuse disposal and utilization seminar; Lexington, KY, USA (11 May 1977).

This paper introduces a new method and apparatus for reducing sulphur and ash content of coal. Some of the four years of actual operational test will be presented. Primarily older mine refuse piles were used in these operational tests. In keeping with the theme of the Seminar, Coal Refuse - An Asset or a Liability, it is maintained that existing refuse piles can be turned from potential liabilities into assets by using this proven method.

51090 (IS—4655, pp 71-73) **Coal blending experiments.** Biggs, D. May 1979.

In Fossil Energy Program. Technical progress report, October 1—December 31, 1978. I. Mining Research and Development-Coal Preparation and Analysis. II. Advanced Research and Technology Development.

To date coal samples have been taken from two mines, the Decker Mine near Decker, Wyoming and the Dahm Mine near Marysville, Iowa. These coals taken from the subject mines and three blends, 25/75, 50/50, and 75/25 have been subjected to ashing in a low temperature ashing furnace where the temperature does not exceed 150°C in an atmosphere of oxygen. This technique successfully oxidizes the organic portion of the coal while leaving the mineral matter associated with it essentially unaltered. It is necessary to form about six grams of low temperature ash to perform the necessary experiments.

COMBUSTION

REFER ALSO TO CITATION(S) 51025, 51032, 51033, 51808, 52089

51091 (BNL—51021) **Coal-oil mixture combustion. Progress report.** Krishna, C.R.; Butcher, T.A.; Spaulding, L.D. (Brookhaven National Lab., Upton, NY (USA)). Mar 1979. Contract EY-76-C-02-0016. 17p. P 02/MF A01.

This year the main thrust of the work was towards examining specific aspects of the production, storage, and use of coal-oil mixtures (COMs) and establishing some areas in which more research is needed. The areas of stability (including the role of additives), atomization and combustion as they relate to coal-oil mixtures (COMs) were considered. The major conclusions are summarized below. Stability for pipeline transport may be attainable with proper design and coal particle size distribution (PSD) and storage stability could probably be accomplished with agitation, the agglomerating properties of the particles being important. The use of additives to promote stability involves considerations of supply and economics as well as of the chemical nature of the coal-oil interface which can depend on the type and history (oxidation, etc.) of the coal and oil. COM sprays may contain significant inhomogeneities and recent work on liquid spray combustion indicates that the atomization characteristics could strongly influence their combustion properties. Little is known of details of COM flames such as heat flux profiles and the measurement of these as functions of fuel and atomizer properties should aid in the design of COM combustors.

51092 (CONF-7606131—, pp 125-130) **Measuring the combustion rate of pulverized lignite.** Leesley, M.E.; Jones, C.E. (Univ. of Texas, Austin). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

The renewed interest in lignite utilization has caused a reevaluation of existing data on the behavior of lignite in combustion and gasification systems. A lack of knowledge exists concerning the combustion mechanism and the kinetics of burning. We review the methods of obtaining these data and show how, in all cases but one, the results may be seriously affected by the experimental method. The cheapest, most accurate method of obtaining a combustion-rate equation for pulverized fuel is to use the one-dimensional experimental furnace. The rate data are not masked by the effects of geometry, radial transport, and recirculation. With an equation derived in this way, the effects of geometry, radial transport, and recirculation can then be modeled to aid the designer to compute flame lengths and heat-release profiles for various fuel/air ratios and initial particle-size distributions. Allowing for experimental difficulties, this modeling can be done using the one-dimensional furnace using less than 10 tons of fuel. We further show how the wide-range particle-size distributions of pulverized lignite need not cause difficulties in obtaining specific reaction-rate equations from the experimental data.

51093 (CONF-7606131—, pp 185-188) **Lignite-fired rotary kiln.** Butler, J.R. (Elgin-Butler Brick Co., Austin, TX). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

The Elgin-Butler Brick Company plants are located approximately 30 miles east of Austin near Elgin, Texas. One plant specializes in manufacturing glazed structural clay products, and the other plant specializes in manufacturing face brick, fire brick, and refractory products. Combined, the plants produce about 75 million modular brick equivalents per year, using approximately 2,500,000 ft^3 of natural gas per day supplied by the LoVaca Gathering Company. This paper reviews experiences in trying to use lignite as a fuel in converting a natural-gas-fired rotary kiln to one fired with lignite.

51094 (FE—2489-37) **Development of combustion data to utilize low-Btu gases as industrial process fuels. Project 61004 annual status report, October 1, 1977—September 30, 1978.** Waibel, R.T.; Fleming, E.S. (Institute of Gas Technology, Chicago, IL (USA)). Feb 1979. Contract EX-76-C-01-2489. 154p. P 08/MF A01.

Combustion data have been collected for natural gas and three low-Btu gases fired on eight different burners. Tests have been completed with the forward-flow baffle burner, kiln burner, nozzle-mix burner, high-forward-momentum burner, flat-flame burner, high-excess-air burner, and premix tunnel burner. Tests are partially completed using the boiler burner. The low-Btu gases simulated for these tests are Koppers—Totzek oxygen, Wellman—Galusha air and Winkler air fuel gases. In each case the burners were mounted on a pilot-scale test furnace, and the firing density and water tube load were adjusted to simulate conditions for a typical burner application. The experimental results allow evaluation of the ease of retrofitting the burners to use the low-Btu gases and provide a comparison of burner and furnace performances with the various fuels.

51095 (METC/CR—78/10) **Fluidized bed flow equations.** Ness, N.; Fanucci, J.B. (West Virginia Univ., Morgantown (USA). Dept. of Aerospace Engineering). Jul 1978. Contract EY-77-C-21-8087. 253p. P 12/MF A01.

This report contains the detailed derivation of the conservation equations of mass, momentum, and energy for a fluidized bed. The development of the chemical production term is included in the Appendix. The equations contain momentum exchange terms, viscosity and thermal conductivity transport coefficients for the fluid and solid, and other flow quantities which require constitutive relations before a solution is attempted. An iterative procedure, involving fluidized bed test data and the solution of these flow equations, could be employed to model these constitutive relations. The equations are then specialized to the one dimensional, steady flow for a high-temperature two-phase chemically reacting multispecies fluid and a single species solid. Solutions to this system are discussed.

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 51790

51096 (DOE/EIA—0007/4) **Coal supplement No. 1 to Winter Energy Data Bulletin of December 21, 1977.** (Department of Energy, Washington, DC (USA). Energy Information Administration). 1977. 9p. P 02/MF A01.

Coal production ceased at mines operating under the UMWA-BCOA contract with the expiration of that contract on December 6. Some western surface mines covered by recently negotiated contracts between the UMWA and individual (non-BCOA) companies continued production. Many nonunion mines, particularly in Kentucky, Ohio, Pennsylvania, Virginia, and West Virginia, were idled by pickets or sympathy strikes. The estimated net result of the first 4 days of the strike was a dropoff of about 6

million tons of production during the week ended December 10, compared with production during the week preceeding the strike. Coal presently supplies about 19% of the US energy requirement which is used for 46% of the Nation's output of electrical energy, 100% of the US coke production, and 15% of the total fuel requirement of industrial and manufacturing plants. Current domestic demand for coal for all uses totals about 13 million tons weekly. The deficit between coal received and coal consumed will be drawn down from existing stocks. Overall, stockpiles for the week ended December 10, 1977, are estimated to total 172 million tons.

51097 (NP—23845) **Bituminous coal 1977/78. Summary of German bituminous coal mining.** (Steinkohlenbergbaus, Essen (Germany, F.R.)). 1978. 89p. (In German). U 05/MF A01.

The German bituminous coal industry in 1977/78 is surveyed first from the aspects of energy economy and energy politics. This includes consideration of the growth of German energy needs and energy sources meeting these needs, the growth of energy costs, consolidation of the German bituminous coal industry, market for German bituminous coal, and coal policies of the European Community. Social policies are discussed with respect to personnel, working conditions, pay systems, and shop organization. (JSR)

HEALTH AND SAFETY

51098 (UCID—18248) **Health and related environmental effects of greatly increased coal use.** Ramsey, W.J.; Thornton, R.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Aug 1979. Contract W-7405-ENG-48. 29p. P 03/MF A01.

There is a wealth of information already published on the health and related environmental effects of coal use. However, thus far such information does not lead to rigorous conclusions regarding those effects. Uncertainty still exists as to which emissions pose the greatest hazards. A recent book summarizes well what is known about air pollution and human health. Several attempts have been made to assess injuries and deaths attributable to the coal utilization system from mining through electrical power generation. Environmental assessments of emerging coal conversion technologies are also being carried out. The high degree of uncertainty in these evaluations justifies concern about future health effects of greatly increased coal use. Neither can we be sanguine about the increasing levels of carbon dioxide in the atmosphere due to increasing fossil fuel combustion and their potential effects on climate. Large-scale changes in climate could lead to, among other effects, civil and international disorder because of a redistribution of areas of agricultural productivity and thus to considerable human suffering.

51099 **Two agencies join in concerted attack on toxic mine substances.** Snyder, K. *Mine Saf. Health;* 4: No. 3, 6-13(Jun 1979).

To ensure the best possible protection to the health of the Nations's miners the Federal Mine Safety and Health Act of 1977 established a partnership between MSHA and the Department of Health, Education and Welfare's National Institute for Occupational Safety and Health (NIOSH). This article surveys cooperative programs of the two agencies.

REGULATIONS

REFER ALSO TO CITATION(S) 50960

51100 (IMMR—32-M4-77, pp 43-45) **Overview of MESA regulations for refuse piles and retaining dams.** Cannon, W.C. (Mining Enforcement and Safety Administration, Barbourville, KY). Dec 1977.

From 3. coal refuse disposal and utilization seminar; Lexington, KY, USA (11 May 1977).

The impetus to develop comprehensive regulations governing the disposal of coal waste began after the Buffalo Creek disaster of February 26, 1972. One of the problems facing industry nd government in early 1972 was the almost complete lack of any substantive engineering design criteria for coal waste structures. No one had really investigated the physical properties of coal refuse from the standpoint of a construction material, nor had there been any publications dealing exclusively with the actual design considerations of refuse disposal facilities. An Engineering and Design Manual - Coal Refuse Disposal Facilities released by the Department of Interior is available through the Government Printing Office, and has done much to alleviate this situation. Included in this manual are discussions of economics, planning, stability analysis, reservoir routing, and spillway design. It is a very useful tool for the companies lacking engineering personnel with specific experience in embankment design and construction. Work has just been completed on a MESA inspection manual for coal waste facilities. This manual is available from Government Printing Office in Washington, DC. Incorporated in this manual are discussions of the critical inspection aspects pertaining to the stability of a facility, descriptions of various facility configurations, and examples of inspection forms. The amended regulations were published in the September 9, 1975, issue of the Federal Register. The regulations are best discussed by dividing them into two parts: those pertaining to refuse piles and those for impounding structures. These regulations are described briefly.

PETROLEUM

REFER ALSO TO CITATION(S) 51219

GEOLOGY AND EXPLORATION

51101 **Exploration and economics of the petroleum industry. Volume 16. New ideas, new methods, and new developments.** Landwehr, M.L. (ed.). New York, NY; Matthew Bender and Company, Inc. (1978). 359p. (CONF-7803107—).

From Institute on petroleum exploration and economics; Dallas, TX, USA (8 Mar 1978).

Fifteen papers were presented at the Institute of Petroleum Exploration and Economics, March 8—9, 1978. The topics related to new ideas, new methods, and new development. Oils, natural gas, synthetic fuels, coals, and fluid hydrocarbons were discussed. The National Energy Plan and other energy issues were analyzed.

DRILLING AND PRODUCTION

REFER ALSO TO CITATION(S) 51814, 52072, 52132

51102 (ORO—5302-30) **Tertiary oil recovery by CO_2 injection. Quarterly report, April—June 1978.** Conner, W.D. (Columbia Gas Transmission Corp., Charleston, WV (USA)). Sep 1978. Contract EF-76-C-05-5302. 29p. P 03/MF A01.

Total water injection for the quarter was 17,370, an increase of approximately 2700 barrels over the previous period. The increase was due to remedial work on the input wells that was completed during March. The only problems occurred during June, when excessive shutdowns resulted from line plugging after moving the water tanks. This problem was subsequently solved. Oil production for the period was 4314 barrels, an increase of approximately 660 barrels over the previous quarter. Although increases in production were experienced in wells outside the pattern, the central producer continued at about 1 barrel per day with increasing water production. Total production attributable to CO_2 injection is 8562 barrels.

51103 (SAN—1395-26) **Pilot demonstration of enhanced oil recovery by micellar polymer waterflooding, phase B. Quarterly report, third quarter 1978.** Staub, H.L. (Long Beach, City of, CA (USA)). 10 Oct 1978. Contract EF-77-C-03-1395. 28p. P 03/MF A01.

Petroleum sulfonate for the Wilmington Micellar-Polymer project in California is under order. The schedule for initiation of micellar slug injection has been delayed until about mid-November. The slug optimization phase must be repeated. Production and injection has been initiated in all wells within the project area; performance is satisfactory. (DLC)

51104 **Shale stabilizing drilling fluid.** Anderson, D.B.; Edwards, C.D. (to Standard Oil Co. (Indiana)). US Patent 4,142,595. 6 Mar 1979. Filed date 13 Feb 1978. 8p.

PAT-APPL-876,976.

A process and composition are described for use in drilling shale and especially in drilling the troublesome types of shale which heretofore have been impossible to drill effectively. The aqueous drilling fluid of this invention so effectively stabilizes the shale that additions to maintain the special drilling fluid can be discontinued or drastically reduced, once the shale formation has been penetrated and drilling below the shale could even be done with conventional drilling fluids. The drilling fluid contains between about 0.2 to 1.5 pounds per barrel of flaxseed gum together with potassium and/or ammonium salts. The potassium and/or ammonium salts are used in quantities to provide a concentration of the cation of the salt of at least 10,000 ppM. As the drilling fluid is a non-clay type, a non-clay viscosifier is used. Preferably, the cation concentration is tailored to drilling fluid salinity such that the cation concentration in parts per million is approximately equal to at least 10,000 x (1 + 0.025 x the sodium chloride salinity in percent saturation).

51105 **Interfacial effects in the displacement of residual oil by foam.** Slattery, J.C. (Northwest Univ, Evanston, Ill). *AIChE J.;* **25**: No. 2, 283-289(Mar 1979).

A qualitative theory is developed to explain the roles of surface tension and the two surface viscosities in the displacement of foams through porous media. There is a critical value of the surface tension above which a foam cannot be displaced under a given pressure gradient. The displacement efficiency of a foam can be raised by increasing the surface tension to only slightly less than this critical value, by increasing the viscosity of the aqueous surfactant solution from which the foam is formed and by increasing the surface viscosities. These predictions are in agreement with available experimental data. 20 refs.

51106 Mechanics of high pressure rock deformation as related to oil and gas recovery. Green, S.J.; Jones, A.H. (Terra Tek, Salt Lake City, UT). pp 324-334 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

This paper is an overview of oil and gas production with the intent of providing background information for other papers relating to oil and gas recovery. The paper is limited to oil and gas recovery, and does not include refining or distribution aspects. The paper presents some introductory comments, some observations of rock behavior under high pressure relevant to the applications to be covered, specific applications including exploration, drilling, completion/stimulation and reservoir engineering, and some brief comments on applicability to other energy resource recovery and development activities beyond oil and gas.

51107 Explosive enhancement of permeability. Hanson, M.; McKee, C.; Terhune, R. (Univ. of California, Livermore). pp 407-425 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Explosives can be used to stimulate the permeability of oil and gas reservoirs and to increase the permeability for in situ processes. This paper discusses the mechanism of permeability enhancement. Most of the key equations and superposition arguments are based on the assumption that the medium behaves in an approximately elastic manner. Additional experimental data are needed to verify the theory. The theory does not distinguish between simultaneous and sequential detonations. In order to implement the theory, accurate calculations of stress or particle velocity decay are required. Comparison between theory and experiment for a single detonation is good. 10 figures. (DLC)

51108 Oil and Gas Conservation Division annual review for the year 1977 relating to oil and gas. Volume 21. Helena, MT; Montana Department of Natural Resources and Conservation (1977). 40p.

Gas production in Montana was 47,234,941 MCF in 1977; oil production was 32,680,054 bbl. Statistics are given for gas and oil production and discoveries in Montana counties. Data on individual oil and gas fields are also compiled. (DLC)

PROCESSING

REFER ALSO TO CITATION(S) 51809

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 51101, 51812, 51813

51109 (DOE/EIA—0134(77-78)) **Supply, demand, and stocks of all oils by P.A.D. districts and imports into the United States, by country.** (Department of Energy, Washington, DC (USA). Energy Information Administration). 27 Oct 1977. 90p. NTIS, PC A05/MF A01.

Supply, demand, and stocks of all oils by P.A.D. district are given in tabular form for May 1977 through April 1978.

51110 (DOE/EIA—0159(76)) **Crude petroleum, petroleum products, and natural gas liquids in P.A.D. District V: year 1976.** (Department of Energy, Washington, DC (USA). Energy Information Administration). 17 Feb 1978. 7p. NTIS, PC A02/MF A01.

P.A.D. District V data are presented in tabular form on comparative analysis of military and civilian petroleum demand (1974—1976), domestic demand for petroleum products (1975, 1976), natural gas liquids and liquefied refinery gases production and stocks, and petroleum supply and demand (1976).

WASTE MANAGEMENT

51111 Third international conference on waste oil recovery and reuse. Washington, DC; Association of Petroleum Re-Refiners (1978). 181p. (CONF-7810186—).

From 3. international conference on waste oil recovery and reuse; Houston, TX, USA (16 Oct 1978).

Twenty-four papers were presented at this conference on the following topics: New Technology Development in Europe and the United States; Monitoring Lube Oil Quality; European Experience; and Changing US Policies and Standards Toward Re-Refined Oil.

51112 Re-refined oil test programs. Thompson, C.J. (US Department of Energy, Bartlesville, OK). pp 79-81 of Third international conference on waste oil recovery and reuse. Washington, DC; Association of Petroleum Re-Refiners (1978).

From 3. international conference on waste oil recovery and reuse; Houston, TX, USA (16 Oct 1978).

The Bartlesville Energy Technology Center (BETC) is believed to be the first documentation in the US of the successful passing of the engine sequence tests by re-refined lubricating oils to meet the API service classification as SE. The US Army MERADCOM/Environmental Protection Agency (EPA) investigated re-refined engine oil. Two field test programs - the San Diego Police Fleet Test and the Iowa State Department of Transportation Test - have been made on re-refined engine oil. The National Bureau of Standards is to develop test procedures to establish substantial equivalency of recycled oils with new oils for a particular end use. A new testing program is being started by US Army MERADCOM to demonstrate the feasibility of producing MIL-L-2104C quality lubricant formulated with a suitable additive treatment and re-refined base oils.

51113 Waste oil recovery and reuse research at the Bartlesville Energy Technology Center. Brinkman, D.W.; Whisman, M.L. (US Department of Energy, Bartlesville, OK). pp 169-175 of Third international conference on waste oil recovery and reuse. Washington, DC; Association of Petroleum Re-Refiners (1978).

From 3. international conference on waste oil recovery and reuse; Houston, TX, USA (16 Oct 1978).

This presentation touched on the highlights of the accomplishments of the Bartlesville Energy Technology Center investigations and included an update on the projected future of the Department of Energy research program on used lubricating oil. The BERC Process was outlined in detail. Future research plans include a study of by-product utilization with possible emphasis on acid sludge and oily-clay wastes. It is hoped at BETC to study adaptation of the BERC process and other technologies to skid-mount small-scale units for operation in less densely populated areas. 3 tables.

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 52148, 52149, 52150, 52160, 52161, 52162, 52163, 52164, 52165, 52166, 52167, 52168, 52169, 52170, 52171, 52172, 52173, 52174, 52175, 52176, 52177, 52178, 52179, 52180, 52182, 52183, 52184, 52189

51114 (PB—288401) **An oilspill risk analysis for the Mid-Atlantic (Proposed Sale 49) Outer Continental Shelf lease area. Water-resources investigations (final).** Slack, J.R.; Wyant, T. (Geological Survey, Reston, VA (USA). Water Resources Div.). Jul 1978. 79p. Y A05/MF A01.

An oil spill risk analysis was conducted to determine the relative environmental hazards of developing oil in different regions of the Mid-Atlantic Outer Continental Shelf lease area. The study analyzed the probability of spill occurrence, likely paths of the spilled oil, and locations in space and time of such objects as recreational and biological resources likely to be vulnerable. These results are combined to yield estimates of the overall oil spill risk associated with development of the proposed lease area. The analysis implicitly includes estimates of weathering rates and slick dispersion and an indication of the possible mitigating effects of cleanups. Assuming that economically recoverable amounts of petroleum are found in the area, the leasing of the tracts proposed for Sale 49 will increase the expected number of spills by about 20-25% over the number expected from the existing (Sale 40) leases. The probability that an object such as land will be contacted by a spill is increased by at most five percentage points.

POLICY, LEGISLATION, AND REGULATION

REFER ALSO TO CITATION(S) 51810, 51811, 51813

51115 (UCRL—52788) **New factors influencing the development of free-world oil resources.** Borg, I.Y. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Jun 1979. Contract W-7405-ENG-48. 45p. P 03/MF A01.

In the past, oil production trends have not always been an accurate indicator of exploration success and development potential. Foreign producers, particularly, have been affected by disruptive situations independent of the geology of their fields - revolutions, wars, and embargoes. These old factors continue to affect production. However, new nongeological factors are having an increasingly potent impact on crude oil supplies worldwide: capricious cut-backs to ensure high prices, conservation practices designed to preserve the unique and finite resources of individual countries, a shift in many oil-rich countries to the export of petroleum products rather than crude oil, a change in the share of heavy oils on world markets (significant because of the inability of some importing countries to utilize them), delays in outer-continental-shelf leasing schedules and related exploration in the US, land withdrawals in the US, and implementation of US legislation such as the Clean Air Act Amendments of 1977, which can prohibit development in pristine areas. Individually, these new phenomena tend to delay rather than forestall development of the world's crude oil; however acting together or with other factors such as political upheavals and natural catastrophes, they can cause or aggravate supply/demand imbalances. As the world supply is depleted, the importance of these nongeological factors promises to increase.

TRANSPORT, PIPELINES, AND HANDLING

51116 (AD-A—060476) **Offshore vessel traffic management (OVTM) study. Volume II. Technical analyses. Final report, August 1977—June 1978.** Bland, R.; Kalafus, R.; Wisleder, R. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Aug 1978. 235p. Y A11/MF A01.

The objectives of the study were: (1) to analyze the causes of tanker and other vessel casualties that could potentially result in oil pollution, and (2) to evaluate various alternative vessel traffic management systems and techniques for the prevention of oil-polluting casualties in the U.S. offshore waters. The geographical areas of interest are the waters from the U.S. coast out to 200 NM around the contiguous 48 states, Hawaii, Puerto Rico, the Virgin Islands and Alaska, except the area north of the Aleutian Islands. Three types of casualties are addressed in the study: groundings, collisions, and rammings. Vessels included in the study are tank vessels (tankers and tank-barges) over 1000 gross tons. The analysis of the causes of tank vessel casualties is performed mainly with the Coast Guard Merchant Vessel Casualty Report (MVCR) data base covering the period from July 1971 to October 1977. Other data sources surveyed include: the Lloyd's Weekly Casualty Reports, the Tanker Casualty Library of Marine Management Systems, Inc., and the Coast Guard Pollution Incident Reporting System. The nature and characteristics of tank vessel casualties that occur in the U.S. offshore waters are described. Systems and techniques considered as alternatives for preventing these casualties are identified, evaluated against each casualty and given an overall rating of casualty prevention effectiveness based on criteria which are defined. The promising systems are selected and conceptual descriptions are presented including the operational features, technical description, cost, staffing and training required, and legal implementation considerations.

51117 (AD-A—060503) **Offshore vessel traffic management (OVTM) study. Volume III. Appendixes. Final report, August 1977—June 1978.** Bland, R.; Kalafus, R.; Wisleder, R.; Frankel, F.; Prerau, D. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Aug 1978. 274p. Y A12/MF A01.

The appendices are: Appendix A - Examples of Merchant Vessel Casualty Reports; Appendix B - Merchant Vessel Casualty Computerized Data Base; Appendix C - Index and Listing of the Data Base Cases; Appendix D - Vessel Traffic Services; Appendix E - Eastern Canada Traffic Regulation; Appendix F - The LORAN-C System and Applications to the OVTM Study; Appendix G - Shore-Based System Design Considerations; Appendix H - Satellites for Offshore Vessel Traffic Management; and Appendix I - Evaluation of Operational Features and Systems.

51118 (PB—287755) **Theoretical model for a slurry pipeline. Technical memo.** Rennert, P. (System Sciences, Inc., Bethesda, MD (USA)). 12 Sep 1975. 37p. Y A03/MF A01.

A mathematical model for describing the theoretical behavior of frozen crude oil slurry in liquid natural gas (LNG) is presented in two modules in the following. The 'Pressure Module' is derived from the Newitt equations and the 'Temperature Module' is derived from the 'Design Considerations and Optimization of a Liquified Natural Gas Pipeline' by Coulter. A final section describes the operation of an HP 9810A calculator version of the model. The model is presented for possible implementation on a larger scale computer. (Portions of this document are not fully legible)

PROPERTIES

REFER ALSO TO CITATION(S) 51112

51119 (DOE/BC/30101—4) **Characterization of high boiling fossil fuel distillates via ^{1}H and ^{13}C NMR analysis. Quarterly report IV, April 1—June 30, 1979.** Barlin, K.D.; O'Donnel, D.J.; Sigle, S. (Oklahoma State Univ., Stillwater (USA). Dept. of Chemistry). 1979. Contract EW-78-S-19-0001. 31p. P 03/MF A01.

The completion of the ^{13}C NMR analysis of the Wilmington polyaromatic-polar fractions 210-76 No. 16, 21 and 26 and the Gach Saran polyaromatic-polar fractions 208-76 No. 15, 20 and 25 completed the investigation of samples submitted under the original contract. The analysis of several additional samples in these series proved helpful in assessing the consistency of the measuring techniques and also permitted a more accurate determination of trends observed within a particular series. Included in these extra samples were Gach Saran polyaromatic-polar fractions No. 23 and 26. The analysis of these two samples were deemed appropriate when it was observed that the last fraction of the Gach Saran and Wilmington PAP series deviated from trends in Ar-C/Al-C observed in every other series investigated to date. The outcome of this investigation of additional fractions is discussed.

COMBUSTION

REFER ALSO TO CITATION(S) 51091

NATURAL GAS

GEOLOGY AND EXPLORATION

51120 (ORO—8215-1) **Studies of New Albany shale in western Kentucky. Final report, December 1, 1977—November 30, 1978.** Schwalb, H.R.; Norris, R.L. (Kentucky Geological Survey, Henderson (USA)). 1978. Contract EW-78-S-21-8215. 69p. P 04/MF A01.

The New Albany (Upper Devonian) Shale in western Kentucky can be zoned by using correlative characteristics distinguishable on wire-line logs. Wells drilled through the shale which were logged by various methods provided a basis for zonation of the subsurface members and units of the Grassy Creek, Sweetland Creek, and Blocher. Structure and isopach maps and cross sections were prepared. The Hannibal Shale and Rockford Limestone were found in limited areas; isopach maps were not made for these members. Samples of cuttings from selected wells were studied in order to identify the contact of the shale with underlying and overlying rock units. A well-site examination of cuttings through the shale section was conducted, and the presence of natural gas was observed in the field. The New Albany Shale has the potential for additional commercially marketable natural gas production. Exploratory drilling is needed to evaluate the reservoir characteristics of the New Albany Shale.

DRILLING, PRODUCTION, AND PROCESSING

REFER ALSO TO CITATION(S) 51106, 51108

51121 (DOE/EIA—0133/76) **World natural gas: 1976.** (Department of Energy, Washington, DC (USA). Energy Information Administration). 12 Apr 1978. 8p. NTIS, PC A02/MF A01.

Natural gas production by countries is presented in tabular form for the years 1972 through 1976. Data are also presented on natural gas used for repressuring or wasted and on world natural gas trade.

51122 **Recovery of natural gas liquids by partial condensation.** Zahn, C.W.; Clayton, H.A. (to Phillips Petroleum Co.). US Patent 4,142,876. 6 Mar 1979. Filed date 29 Apr 1977. 8p.

PAT-APPL-792,365.

In the recovery of natural gas liquids by partial condensation, flashing, and compression, minimum and maximum temperature control of partially condensed feed stream hydrocarbons to a product separator is imposed by a minimum temperature control system which provides the same set point to the pressure controllers on the compressor suction scrubbers for both the product and the flashed vapor produced from the liquid outlet of the product separator with one of the two output signals responsive to the pressure of the product suction scrubber or the flashed vapor suction scrubber manipulating, by way of a selective relay, the engine speed controller of the dual compressor unit taking suction from the two scrub-

bers; and a maximum temperature controller which controls the rate of by-pass of natural gas feed around the partial condensation—separation system unless, by means of a selective relay, compressor availability is a more limiting criterion.

PRODUCTS AND BY-PRODUCTS

51123 (DOE/EIA—0132(77-78)) **Products of natural gas processing plants: May 1977—May 1978.** (Department of Energy, Washington, DC (USA). Energy Information Administration). 1978. 13p. NTIS, PC A02/MF A01.

Tabular data are presented on production and stocks of products of natural gas processing plants in the United States for the period May 1977 through May 1978.

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 51121

51124 (DOE/EIA—0102/5) **Evaluation of natural gas pricing proposals.** (Department of Energy, Washington, DC (USA). Energy Information Administration). Jun 1978. 196p. P 09/MF A01.

The results of an EIA analysis of several natural gas pricing proposals currently before the Congress, as compared to continued current regulations on natural gas markets are presented. For the purpose of this report the Series C Projection in the EIA Administrator's Annual Report was chosen to represent the reference case. The other reference cases used in that Annual Report would if used, change this analysis of impacts accordingly. The prices and quantities shown are for 1985 unless otherwise noted. The major impacts of the various proposals, using the Series C Projections, are summarized.

ENVIRONMENTAL EFFECTS

51125 (RLO—2229/T15-2) **Comprehensive bibliography and index of environmental information along the three alternative gas pipeline routes.** Buck, E.H.; Allen, A.; Olshansky, R.B.; Pennell, S.H. (Alaska Univ., Anchorage (USA). Arctic Environmental Information and Data Center). Apr 1978. Contract EY-76-S-06-2229-015. 325p. P 14/MF A01.

The bibliography was compiled to provide increased access to environmental information pertinent to the three alternative natural gas pipeline routes from Prudhoe Bay through Alaska. Only the Alaskan segment of each of these routes was included. 754 citations were included which discussed environmental features within 15 miles of any segment of any of the three pipeline routes. The indexes cover author, geographic location, earth sciences, taxonomic, and keyword.

ARTIFICIAL STIMULATION, PLOWSHARE, ETC.

REFER ALSO TO CITATION(S) 51107, 52131, 52132

POLICY, LEGISLATION, AND REGULATION

REFER ALSO TO CITATION(S) 51802, 51806

TRANSPORT, PIPELINES, AND HANDLING

REFER ALSO TO CITATION(S) 51118, 51125

COMBUSTION

REFER ALSO TO CITATION(S) 51094

OIL SHALES AND TAR SANDS

51126 **Federal efforts to promote oil shale.** Petzrick, P. pp 979-982 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Every realistic computation shows oil shale as the cheapest alternative to petroleum as a source of liquid fuel, but industry and potential investors do not have confidence that an oil-shale operation is a good business venture. To be a good business venture three elements must be present: the venture must control adequate resources to support the venture for its economic life; there must be an economic extraction technology; and there must be a market for the products of the venture. the author uses these three elements to discuss the impediments to oil-shale development and related Federal efforts on oil shale. He then lists four specific actions that may ease uncertainties for the development of oil shale: Senator Haskell revived his legislation for construction of oil shale modules and Senator Hart is interested in sponsoring legislation to protect the environment in Colorado during initial oil shale operations; Senator Talmadge's proposed $3/bbl tax credit; the national security interests of DOD gave rise to discussion with DOE of a possible joint shale oil production project; and oil shale was being considered as part of the energy supply strategy for National Energy Plan II. (MCW)

RESERVES AND EXPLORATION

51127 (IDO—1683-1(Vol.1)) **Dawsonite and Nahcolite survey. Volume 1. Reserves, technology, economics, and market assessment.** Farris, C.B.; Mains, C.J. (Colorado School of Mines, Golden (USA). Research Inst.). Apr 1978. Contract EC-77-S-07-1683. 169p. P 08/MF A01.

A survey report is presented for dawsonite and nahcolite, based on a bibliography and supplementary information obtained from researchers and mineral experts in the US. This report discusses resources, technology, economics, and market assessment from 1978 to 2000. It is estimated that in the Piceance Creek Basin of northwestern Colorado, there are approximately 27 billion tons of dawsonite and 30 billion tons of nahcolite, codeposited with portions of a vast oil shale deposit. All areas where the saline minerals and oil shale have been codeposited are controlled by the Federal government, with three exceptions. It is currently believed that all other oil shale properties lack recoverable quantities of dawsonite and/or nahcolite. Dawsonite and its derivatives can be used in the alumina, aluminum, catalyst, plastics, and water-treatment industries. Only the alumina and aluminium are large enough to absorb potential production by 2000. Nahcolite and its derivatives can be used in the flue gas scrubbing, glass, soda ash, and potentially dawsonite-recovery industries. Only flue gas scrubbing is likely to be a sufficiently large outlet to absorb potential nahcolite production by 2000.

51128 (IDO—1683-1(Vol.2)) **Dawsonite and nahcolite survey. Volume 2. Dawsonite and nahcolite bibliography with abstracts.** Farris, C.B.; Leland, E.H. (Colorado School of Mines, Golden (USA). Research Inst.). Apr 1978. Contract EC-77-S-07-1683. 112p. P 06/MF A01.

The Dawsonite and Nahcolite Survey included a world-wide literature search. This volume comprises a bibliography, with abstracts included for each citation, representing the results of that search. The author's abstract was used directly if it was included as part of a paper. In many cases, however, these abstracts were too general for the purposes of this study and the author's abstract was expanded. In some cases, the author's abstract was edited to highlight dawsonite and nahcolite aspects. Foreign-language papers were translated only sufficiently to determine their relevance to the Piceance Creek mineral depsits. Generally, these papers reported on foreign deposits and were of limited value. Abstracts are categorized into the following subjects: general, geology and mineralogy, reserves and exploration, mining and processing, properties and their determination, environmental, uses, and competing alumina raw materials and processes.

51129 (UCRL—52687) **Oil shale resource assessment for in situ retorting, Phase 1: Piceance Creek Basin, Colorado.** Carpenter, R.H.; Gentry, D.W.; Krum, G.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 22 Mar 1979. Contract W-7405-ENG-48. 79p. P 05/MF A01.

It was decided that the resource potential could best be shown by delineating zones or areas that contained a given thickness of oil shale at various grades. Thicknesses in multiples of 400 ft were chosen for the assessment. Oil shale grades were contoured for specific thickness intervals. The study suggested that the Piceance Creek Basin has a large resource base, with physical dimensions and qualities amenable to in situ processing. A conservative estimate revealed some 384 billion barrels of oil in thickness intervals of $\geqq$ 400 ft and some 309 billion barrels in thicknesses of $\geqq$ 1600 ft. These calculations of the resource base may represent only a fraction of the total within the basin.

DRILLING, FRACTURING, AND MINING

REFER ALSO TO CITATION(S) 52132

51130 Calculation of oil shale fractures generated by a column of explosive in a borehole. Kipp, M.E. (Sandia Labs., Albuquerque, NM). pp 426-432 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

The tensile fractures resulting from an end detonated column of explosive in an elastic—plastic medium tend to be maximized at the end opposite from the detonation point. Radial fractures are the dominant type observed in the present calculations, but a more refined anisotropic fracture model may amend that result. The relation between laboratory data obtained at high strain rates, and field experiments involving lower strain rates emerges as a significant factor in the extent of fractures calculated.

51131 Computer simulation of fracture in small scale borehole expeeriments in oil shale. Murri, W.J.; Curran, D.R.; Shockey, D.A.; Seaman, L.; Tokheim, R.E.; McHugh, S.L.; Young, C. (SRI International, Menlo Park, CA). pp 466-472 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

The crack size distributions in 20-gal/ton and 40-gal/ton oil shale are comparable for nearly equal input conditions. The crack density showed little variation with depth in the 40-gal/ton oil shale. The density of small radial cracks near the borehole may be increased by an order of magnitude by detonating an explosive twice in the same borehole. The corresponding permeability increases nearly five orders of magnitude with each detonation. The results of the small-scale borehole experiments have demonstrated important advantages over other techniques. The shock-loaded oil shale is easily sectioned on arbitrary planes, readily providing a thorough, three-dimensional picture of the extent of fracture and fragmentation. Instrumentation with stress or strain gages, or both, is relatively simple and straightforward. The smallness of the specimens is conducive to postexperiment permeability measurements. Such small-scale experiments should continue in order to supplement and help guide large-scale field experiments. 8 figures.

51132 Computational model for explosive fracture of oil shale. Shockey, D.A.; Murri, W.J.; Tokheim, R.E.; Young, C.; McHugh, S.L.; Seaman, L.; Curran, D.R. (SRI International, Menlo Park, CA). pp 473-482 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Mathematical equations were derived to describe the three stages of dynamic fracture: crack nucleation, crack coalescence, and fragmentation. Plate-impact experiments were performed. Agreement between computed and observed fragment size distributions is encouraging. 6 figures, 2 tables. (DLC)

OIL PRODUCTION, RECOVERY, AND REFINING

IN SITU METHODS, TRUE AND MODIFIED

REFER ALSO TO CITATION(S) 51017, 51129, 51138

51133 (TID—28943) **Occidental vertical modified in situ process for the recovery of oil from oil shale, phase 1. Quarterly progress report, May 1—July 31, 1978.** Loucks, R.A. (Occidental Oil Shale, Inc., Grand Junction, CO (USA)). Aug 1978. Contract EY-77-A-04-3873. 308p. P 14/MF A01.

Work at Logan Wash during May, June, and July involved post-rubblization construction of Retort 6, flow and tracer testing of the retort, and running a small scale start-up field test to verify the start-up procedure proposed for Retort 6. Ignition is planned for late August 1978. At the C-b tract, the shaft collaring for the production, service and ventilation/escape shafts, the consolidation grouting around the service and production shafts, and excavation of the vertical segment of the service shaft air inlet were completed. Various building and concrete batch plant construction activities continued.

51134 (TID—29381) **Simultaneous measurement of the thermal and electrical conductivity of Green River oil shale. Final report, June 2, 1976—August 30, 1977.** DuBow, J. (Colorado State Univ., Fort Collins (USA). Engineering Research Center). 1978. Contract ET-78-S-03-1748. 102p. P 06/MF A01.

Goal was to investigate the thermal environmental effects of in-situ retorting operations. Conclusion is that the insulating nature of the shale and the surrounding country rock are such as to make the thermal pollution due to in-situ retorting an insignificant environmental hazard. An estimate of minimum pillar thickness for pillar temperatures below 250°C can be made from the calculations. Thermal conductivity of Green River oil shale decreases with temperature, and 30% anisotropy exists parallel and perpendicular to the sedimentary varve lines. 31 figures, 3 tables. (DLC)

51135 Gas withdrawal from an in situ oil shale retort. Mills, E.A. (to Occidental Oil Shale, Inc.). US Patent 4,140,343. 20 Feb 1979. Filed date 14 Feb 1977. 20p.

PAT-APPL-768,580.

Liquid and gaseous products are recovered from oil shale in an in situ oil shale retort containing a fragmented permeable mass of particles containing oil shale by retorting oil shale in the fragmented mass to produce gaseous and liquid products. The liquid products are withdrawn from the retort to a first level in unfragmented formation below the elevation of the bottom boundary of the retort. Gaseous products are withdrawn from the retort to a second level below the elevation of the first level.

51136 Method of extracting oil. Vriend, J.A. US Patent 4,140,182. 20 Feb 1979. Filed date 24 Mar 1977. 6p.

PAT-APPL-780,715.

A method of extracting oil from an underground bed of an oil-bearing mineral. The method comprises introducing a plurality of conduits into a first, lower part of the bed. Each conduit is spaced from its neighbors and includes a relatively coarse filter at its lower end and contains a relatively fine filter and a lift pump. A first conduit of the plurality of conduits extends to a depth less than the depth of its neighbors. The pressure in the first conduit is reduced. A solvent for the oil is introduced into those conduits at ambient pressure so that the solvent is drawn towards the first conduit and forms a flow path in the bed as it is drawn to the first conduit. The oil-solvent solution is pumped from the first conduit and the space left in the first area after extraction of the oil is filled with water. The conduits are raised to a second, higher part of the bed when all oil has been extracted from the first lower part and the flow direction is recovered by having the first conduit extend to a depth greater than the depth of its neighbors and reducing the vacuum in the neighbors. Oil and solvent are pumped from the neighbors. The conduits are successively raised and the flow direction changed for successive, higher parts of the bed.

SURFACE METHODS

REFER ALSO TO CITATION(S) 51003

REFINING

51137 Heavy oil recycle to reduce operating pressure for non-fouling operation in thermal hydrocracking. Khulbe, C.P.; Pruden, B.B.; Denis, J.M. (Canada Centre for Mineral and Energy Tech., Ottawa). pp 346-355 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Although the hydrogen content of pitch (liquid product) was less than 6.8 wt %, little coke was found in the reactor even after more than 300 hrs of operation. Fouling of the reactor or other equipment due to solid deposits could be very much reduced, and the thermal hydrocracking pilot plant could be operated for extended periods of time without major operational problems at 13.89 MPa by recirculating a portion of the heavy oil. Product quality was slightly improved for recycle compared to once-through operation. The shorter first-feed-pass residence time coupled with the high ash content in the reactor fluid and increased linear velocity are possible reasons for reduced coke deposition. The linear velocity is important when considering scale-up since larger reactors will have higher linear velocities for the same LHSV than smaller reactors.

PURIFICATION

51138 Two-stage removal of sulfur dioxide from process gas using treated oil shale. Ridley, R.D.; Cha, C.Y. (to Occidental Oil Shale, Inc.). US Patent 4,140,181. 20 Feb 1979. Filed date 9 Dec 1977. 14p.

PAT-APPL-859,185.

Sulfur dioxide is removed from a process gas by passing the process gas through a first fragmented permeable mass of particles containing treated oil shale and including alkaline earth metal oxides at a sufficient temperature to remove sulfur dioxide from the process gas. Gas containing sulfur dioxide from the first fragmented mass is passed through a second fragmented permeable mass of particles

containing treated oil shale and including alkaline earth metal oxides. Water in the second fragmented mass combines with alkaline earth metal oxides in the second fragmented mass and sulfur dioxide in the gas from the first fragmented mass with resultant removal of sulfur dioxide from gas from the first fragmented mass.

PROPERTIES AND COMPOSITION

REFER ALSO TO CITATION(S) 51013, 51134

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 52233

ENVIROMENTAL ASPECTS

REFER ALSO TO CITATION(S) 51003, 51060

NUCLEAR FUELS

RESERVES

REFER ALSO TO CITATION(S) 51538

51139 (GJBX—108(79)) **Selected references on uranium geology and potential resources of uranium.** Chenoweth, W.L.; Learned, E.A. (comps.). (Department of Energy, Grand Junction, CO (USA). Grand Junction Office). Apr 1979. Contract EY-76-C-13-1664. 23p. P 02/MF A01.

This selected list is an update from the list in the publication GJO-111(76) National Uranium Resource Evaluation, Preliminary Report. No reports dealing with aerial surveys and the hydrogeochemical and stream-sediment reconnaissance are included here. A complete list of reports generated by the NURE program are included in GJO-111(79) National Uranium Resource Evaluation, Interim Report.

EXPLORATION

51140 (GJBX—80(79)) **Calculated time-correlated neutron-induced radiations in a sandstone formation. Final report.** Peters, C.W.; Karaoglan, E.I. (Consolidated Controls Corp., Springfield, VA (USA)). Mar 1979. Contract EY-76-C-13-1664. 98p. P 05/MF A01.

The following signals from the proposed Borehole Neutron Diagnostic Probe, which uses the associated particle technique for timing and spatial resolution of the events produced by 14 MeV neutrons, in a 4.5 inch borehole in a sandstone formation were investigated: (1) The inelastic gamma-ray spectrum by a gamma ray spectrometer whose signal input is correlated with the time emission of a 14 MeV neutron into the formation. (2) The capture gamma-ray spectrum measured by a gamma ray spectrometer whose signal input is not correlated with neutron emission and has the time correlated events gated out. (3) The time dependence of the inelastic gamma-ray signal. (4) The time dependence of the capture gamma-ray signal. (5) The measured coincidence signal from the detection of prompt gamma rays and prompt neutrons from fission.

51141 (GJBX—113(79)(Vol.1)) **Aerial gamma ray and magnetic survey: Powder River R and D Project. Portions of the: Forsyth and Hardin, Montana, and the Sheridan, Arminto, Newcastle, and Gillette, Wyoming Quadrangles. Final report.** (GeoMetrics, Inc., Sunnyvale, CA (USA)). May 1979. Contract EY-76-C-13-1664. 80p. Dep. NTIS, PC E05/MF A01.

During the months of August through September, 1978, geoMetrics, Inc. flew approximately 1520 line miles of high sensitivity airborne radiometric and magnetic data in Wyoming and southern Montana within four 1° x 2° NTMS quadrangles (Arminto, Sheridan, Hardin and Forsyth), and 1390 lines miles in the detail area in eastern Wyoming, as part of the Department of Energy's National Uranium Resource Evaluation program. All radiometric and magnetic data were fully reduced and interpreted by geoMetrics, and are presented as three volumes (one Volume I and two Volume II's) in this report. The survey area lies largely within the northern Great Plains Physiographic Province. The deep Powder River Basin is the dominant structure in the area. Portions of the Casper Arch, Big Horn Uplift, and Porcupine Dome fall within the western limits of the area. The Basin is one of the largest and deepest in the northern Great Plains and contains over 17,000 feet of Phanerozoic sediments at its deepest point. Economic deposits of oil, coal, bentonite and uranium are found in the Tertiary and/or Cretaceous rocks of the Basin. Epigenetic uranium deposits lie primarily in the Pumpkin Buttes - Turnercrest districts within arkosic sandstones of the Paleocene Fort Union Formation. A total of 62 groups of statistical values for the R and D area and 127 for the Arminto Detail in the uranium window meet the criteria for valid anomalies and are discussed in their respective interpretation sections. Most anomalies lie in the Tertiary sediments of the Powder River Basin. Some of the anomalies in the Arminto Detail are clearly related to mines or prospects.

51142 (GJBX—116(79)(Vol.2)(Albuquerque)) **Aerial gamma ray and magnetic survey, Raton Basin Project. Volume II. Albuquerque Quadrangle, New Mexico. Final report.** (GeoMetrics, Inc., Sunnyvale, CA (USA)). Jun 1979. Contract EY-76-C-13-1664. 313p. P 14/MF A01.

The Albuquerque 1° x 2° sheet covers portions of eight major geologic strucures, which from west to east are: (1) the San Juan Basin; (2) the Zuni Uplift; (3) the Mt. Taylor Volcanic Field; (4) the Puerco Platform; (5) the Nacimiento Uplift; (6) the Jamez Volcanic Field; (7) the Rio Grande Rift and; (8) the Sandia Uplift. Most exposed rocks in the quadrangle are Mesozoic sediments, Tertiary volcanics and Quaternary units with minor Paleozoic and Precambrian rocks within the uplifts. Uranium ore is currently being produced from the large Jurassic sandstone deposits (114,862 tons of U_3O_8) at Ambrosia Lake and the Laguna District. Scattered uranium occurrences exist in various Precambrian, Paleozoic and Mesozoic rocks throughout the quadrangle. A total of 99 groups of statistically anomalous uranium samples were defined as anomalies and discussed in the report. Several anomalies are associated with the major uranium districs. Others are associated with geologic units known to contain uranium occurrences in the quadrangle and elsewhere. the largest number of anomalies occur in Cretaceous sediments of the San Juan Basin in the Meneffee Formation. Magnetic data generally outline the major geologic structures, except where the overlying Tertiary volcanics obscure the deeper magnetic sources.

51143 (GJBX—116(79)(Vol.2)(Gallup)) **Aerial gamma ray and magnetic survey, Raton Basin Project. Volume II. Gallup Quadrangle, Arizona/New Mexico. Final report.** (GeoMetrics, Inc., Sunnyvale, CA (USA)). Jun 1979. Contract EY-76-C-13-1664. 285p. P 13/MF A01.

The Gallup 1° x 2° quadrangle includes portions of 5 major geologic structures which from east to west are: (1) the San Juan Basin; (2) the Zuni Uplift; (3) the Gallup Sag; (4) the Defiance Uplift; and (5) the Black Mesa Basin. Portions of the Mount Taylor and Hopi Buttes Volcanic Fields are present in the southeastern corner and the eastern edge respectively. Most exposed rocks in the quadrangle are Mesozoic and Tertiary sediments, and Quaternay surficial units, with minor amounts of Paleozoic and Precambrian rocks within the uplifts. Uranium ore is currently being produced from the large Jurassic and Cretaceous sandstone deposits in the Smith Lake and Gallup Mining Districts. Scattered uranium occurrences exist in various Precambrian, Paleozoic and Mesozoic rocks throughout the quadrangle. A total of 129 groups of statistically anomalous uranium samples were defined as anomalies and discussed in the report. Several anomalies are associated with the major uranium districts. Others are associated with geologic units known to contain uranium occurrences in the quadrangle and elsewhere. The largest number of anomalous samples occur in scattered exposures of surficial deposits, and in the Triassic Chinle Formation near the quadrangle's western edge. Magnetic data generally outline the major geologic structures, except where overlying Tertiary volcanics obscure the deeper magnetic sources. Some magnetic responses outline areas which do not reflect structure as mapped by Hackman and Olson (1977) on the Dakota Sandstone Base, and may result from deeper magnetic sources.

51144 (GJBX—116(79)(Vol.2)(Shiprock)) **Aerial gamma ray and magnetic survey, Raton Basin Project. Volume II. Shiprock Quadrangle, Arizona/New Mexico. Final report.** (GeoMetrics, Inc., Sunnyvale, CA (USA)). Jun 1979. Contract EY-76-C-13-1664. 294p. P 13/MF A01.

The Shiprock 1° x 2° sheet covers portions of five major tectonic features: (1) San Juan Basin; (2) De Chelly Uplift; (3) Black Mesa Basin; (4) Defiance Uplift; and (5) Monument Uplift. Medsozoic sedimentary rocks dominate the lithology of the quadrangle. Scattered Tertiary volcanics are present. Uranium is being produced from epigenetic deposits in the Triassic Chinle and Jurassic Morrison Formations. A total of 130 statistical anomalies were defined of which a representative number are discussed. Only a small proportion of the anomalies were associated with known districts. The bulk of the anomalies were not associated with geologic units known to produce uranium elsewhere. The largest number of anomalies occurred in the Menefee Formation of Cretaceous age, although the highest count rate averages were observed in volcanics. The single largest anomaly appears associated with a mine location. Magnetic

data in general define major structure, but only marginally reflect structural features in the overlying sediments.

51145 (GJBX—126(79)(Vol.1)) **Aerial radiometric and magnetic reconnaissance survey of portions of Arizona, Idaho, Montana, New Mexico, South Dakota and Washinton. Volume 1. Instrumentation and methods. Final report.** (Texas Instruments, Inc., Dallas (USA)). Mar 1979. Contract EY-76-C-13-1664. 68p. P 04/MF A01.

Instrumentation and methods described were used for a Department of Energy (DOE) sponsored high-sensitivity, aerial gamma-ray spectrometer and magnetometer survey of the Butte, Choteau, Cut Bank, Great Falls, Havre, Lewistown, Shelby (Montana); Pocatello, Twin Falls (Idaho); Ritzville (Washington); Hot Springs (South Dakota); and St. Johns (Arizona-New Mexico) NTMS, 1:250,000-scale quadrangles. The survey was carried out by Texas Instruments Incorporated under Bendix Field Engineering Corporation Sub-contract No. 78-184-L. The objective of the work was to define areas showing surface indications of a generally higher uranium content where detailed exploration for uranium would most likely be successful. A Sikorsky S-58T helicopter equipped with a high-sensitivity gamma-ray spectrometer and ancillary geophysical and electronic equipment was employed for areas having the ruggedest terrain, including all of Butte and Choteau Quadrangles. A DC-3 aircraft carrying a more sensitive gamma-ray spectrometer system was used in regions of flatter terrain, including all of Shelby and Lewistown Quadrangles. The systems were calibrated using DOE calibration facilities at Grand Junction, Colorado, and Lake Mead, Arizona. Gamma-ray spectometric data were processed to correct for variations in atmospheric, flight, and instrument conditions and were statistically evaluated to remove the effects of surface geologic variations. The resulting first-priority uranium anomalies (showing simultaneously valid eU, eU/eTh, and eU/K anomalies) were interpreted to evaluate their origin and significance. Results of the interpretation in the form of a preferred anomaly map, along with significance-factor profile maps, stacked profiles, histograms, and descriptions of the geology and known uranium occurrences are presented in the individual quadrangle volumes of this final report.

51146 (GJBX—126(79)(Vol.2E)) **Aerial radiometric and magnetic reconnaissance survey of portions of Arizona, Idaho, Montana, New Mexico, South Dakota and Washington. Volume 2-E. Great Falls Quadrangle. Final report.** (Texas Instruments, Inc., Dallas (USA)). Jun 1979. Contract EY-76-C-13-1664. 149p. Dep. NTIS, PC E08/MF E08.

The results of a high-sensitivity, aerial, gamma-ray spectrometer and magnetometer survey of the Great Falls Quadrangle, Montana, are presented. Statistical and geological analysis of the radiometric data revealed 92 uranium anomalies worthy of field-checking as possible prospects. Four anomalies associated with Mississippian rocks may be indicative of uranium in Mission Canyon Limestones. Three anomalies in Jurassic rocks may point to mineralization in the Morrison Formation. The Cretaceous Colorado Shale has the greatest surface exposure in this quadrangle, and it also registers the greatest number of anomalies. Although this unit contains shale and bentonite that may be uranium-rich, the 64 anomalies associated with this unit are considered significant in that possible sandstone-type uranium deposits may be discovered. Other units that may host sandstone-type deposits include the Eagle Sandstone and the Kootenai Formation. Abundant carbonaceous material in the Eagle Sandstone, particularly in the northeast, may have caused the precipitation of uranium from ground waters that may have leached uranium from bentonite in the Colorado Shale. Six anomalies pertain to the Eagle Sandstone, and five are related to the Kootenai Formation. Four anomalies associated with Cretaceous volcanics may point to possible vein-type deposits. Anomalies related to Quaternary deposits may be significant in that they could reflect uranium-rich source rocks that may contain uranium mineralization.

51147 (K/UR—125) **Hydrogeochemical and stream sediment reconnaissance basic data for Amarillo NTMS quadrangle, Texas.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 31 May 1979. Contract W-7405-ENG-26. 263p. Dep. NTIS, PC A06/MF A01.

Results of a reconnaissance geochemical survey of the Amarillo Quadrangle, Texas are reported. Field and laboratory data are presented for 1,116 groundwater and 644 stream sediment samples. Statistical and areal distributions of uranium and possible uranium-related variables are displayed. A generalized geologic map of the survey area is provided, and pertinent geologic factors which may be of significance in evaluating the potential for uranium mineralization are briefly discussed. The groundwater data indicate three different areas with anomalous uranium concentrations. The largest area is located in the west central part of the quadrangle where wells produce from Permian and Triassic units. This trend passes through Hutchinson, Moore, and Potter Counties. A second area is located in the southeast portion of the quadrangle where wells produce from Permian units. In the southwest corner, high uranium concentrations were observed in groundwaters produced from the Ogallala Formation. In all three trends, associated elements reflect the pesence of brines and evaporite deposits. Sandstone-type associations do occur in the Ogallala Formation. Stream sediment data indicate that most of the uranium in sediments from the Ogallala and Quaternary deposits occurs as resistate and heavy minerals.

51148 (GJBX—126(79)(Vol.2-B)(Shelby)) **Aerial radiometric and magnetic reconnaissance survey of portions of Arizona, Idaho, Montana, New Mexico, South Dakota and Washington. Volume 2-B. Shelby Quadrangle. Final report.** (Texas Instruments, Inc., Dallas (USA)). Jun 1979. Contract EY-76-C-13-1664. 234p. P 11/MF A01.

The results of a high-sensitivity, aerial, gamma-ray spectrometer and magnetometer survey of the Shelby Quadrangle, Montana, are presented. Statistical and geological analysis of the radiometric data revealed 75 uranium anomalies worthy of field-checking as possible prospects. Nine anomlies are associated with the Judith River Formation. Lignite beds in this formation may have created an environment favorable for the precipitation of uranium from uranium-rich ground waters. Possible sources for uranium include volcanic ash and bentonite in Tertiary sediments, the Hell Creek Formation, Bearpaw, Claggett, and Colorado Shales, as well as the alkaline igneous rocks of the Sweet Grass Hills. Eight anomalies related to the Eagle and Virgelle sandstones may reflect the presence of sandstone-type uranium deposits in these units. These anomalies are particularly strong and extensive in the southeastern part of the quadrangle. Twenty-four anomalies in the Colorado Shale may be indicative of sedimentary uranium deposits. The anomalies in the northwest associated with this unit may be a consequence of radioactive residues in oil-well sumps. Two anomalies in the quadrangle pertain to Tertiary rocks. The anomaly near East Butte in the Sweet Grass Hills may be indicative of vein-type deposits in alkaline igneous rocks. The second anomaly may mark the site of epigenetic uranium in lignites. Anomalies related to Quaternary deposits may be significant in that they could reflect uranium-rich source rocks that may contain uranium mineralization.

51149 (GJBX—126(79)(Vol.2-A)(CUT-BANK)) **Aerial radiometric and magnetic reconnaissance survey of portions of Arizona, Idaho, Montana, New Mexico, South Dakota and Washington. Volume 2-A. Cut Bank Quadrangle. Final report.** (Texas Instruments, Inc., Dallas (USA)). May 1979. Contract EY-76-C-13-1664. 182p. P 09/MF A01.

The results of a high-sensitivity, aerial, gamma-ray spectrometer and magnetometer survey ofthe Cut Bank Quandrangle, Montana, are presented. Instrumentation and methods are described in Volume 1 of this final report. This work was done by Texas Instruments Incorporated under Bendix Field Engineering Corporation Subcontract No. 78-184L as part of the US Department of Energy National Uranium Resource Evaluation (NURE) Program. Statistical and geological analysis of the radiometric data revealed 40 uranium anomalies worthy of field-checking as possible prospects. Eight anomalies are associated with Precambrian quartzites, argillites, and limestones in the Northern Rockies physiographic province. One anomaly in this province is associated with Cambrian rocks and may be caused by uranium prospects in the Flathead Quartzite. In the Great Plains physiographic province, the presence of possible sandstone-type uranium prospects is indicated by thirty-one anomalies associated with Cretaceous to Quaternary sedimentary rocks. Two major belts of first-priority anomalies are noteworthy. The first is a northwesterly trending zone in the Rockies that may be structurally controlled, and the second is a northwesterly trending belt west of the Sweet Grass Arch that may be stratigraphically controlled.

ENRICHMENT

51150 (ORO—770) **Final statements for Uranium Enrichment Services Activity for fiscal year 1978.** (Department of Energy, Washington, DC (USA)). 1978. 15p. P 02/MF A01.

The Uranium Enrichment Services Activity (UESA) is the Government's investment in uranium enrichment. US DOE is required to see that prices are established on the basis of recovery of the Government's costs over a reasonable period of time. The financial statements presented provide information on the operations and financial position of UESA. (DLC)

51151 **High-enrichment steady-state cascade performance.** Emanuel, G. (Los Alamos Scientific Labs., NM). *Nucl. Technol.;* **43**: No. 3, 314-327(May 1979).

Cascade performance is examined when the degree of enrichment per separative unit is arbitrary, but not small. An approach is developed that is applicable to new technologies which project significant enrichment per unit. Analysis shows that ideal operation and minimum separative work do not occur concurrently and that neither is a reliable guide for optimizing costs for a small cascade. Cascade performance is studied in a systematic manner that keeps the feed assay, the product assay, and the amount of product fixed. Many small cascade configurations are examined, and the results are combined with a hypothetical operating curve, thereby generating a

simplified relative cost evaluation. Three costs are considered: feed, mechanical pump power, and laser power. No single configuration optimizes all three, but the analysis does indicate the superiority of a few of the examined configurations. 8 figures, 2 tables.

CENTRIFUGATION

51152 Separative performance transients in a gas centrifuge. Olander, D.R. (Univ. of California, Berkely). *Nucl. Technol.;* **44**: No. 2, 307-314(Jul 1979).

A general method has been developed to calculate the behavior of the exit compositions from a gas centrifuge under unsteady conditions. The method utilizes the basic enrichment gradient equations derived by Cohen, which, in this case, contain time derivatives of the partial ^{235}U inventories. These partial differential equations are converted to ordinary differential equations by a linear approximation to the axial concentration distribution for use in the inventory terms only. With this simplification, analytical solution is possible for the feed concentration transient. The transient driven by a change in the feed flow rate, however, requires numerical solution. For analysis of ideal cascades in the unsteady state, the transient flow and separation characteristics of the centrifuge must be combined with total uranium and ^{235}U material balances on each stage.

FUELS PRODUCTION AND PROPERTIES

REFER ALSO TO CITATION(S) 51485, 52027, 52152

51153 (HEDL-SA—1763-FP) **Oxygen-to-metal ratio control during fabrication of mixed oxide fast breeder reactor fuel pellets.** Rasmussen, D.E.; Benecke, M.W.; Jentzen, W.R.; McCord, R.B. (Hanford Engineering Development Lab., Richland, WA (USA)). May 1979. Contract EY-76-C-14-2170. 32p. (CONF-790602—77). P 03/MF A01.

From ANS annual meeting; Atlanta, GA, USA (3 Jun 1979).

Oxygen-to-metal ratio (O/M) of mixed oxide fuel pellets can be controlled during fabrication by proper selection of binder (type and content) and sintering conditions. Sintering condition adjustments involved the passing of Ar—8% H_2 sintering gas across a cryostat ice bath controlled to temperatures ranging from -5 to -60°C to control as-sintered pellet O/M ratio. As-sintered fuel pellet O/M decreased with increasing Sterotex binder and PuO_2 concentrations, increasing sintering temperature, and decreasing sintering gas dew point. Approximate relationships between Sterotex binder level and O/M were established for PuO_2—UO_2 and PuO_2—ThO_2 fuels. O/M was relatively insensitive to Carbowax binder concentration. Several methods of increasing O/M using post-sintering pellet heat treatments were demonstrated, with the most reliable being a two-step process of first raising the O/M to 2.00 (stoichiometric) at 650°C in Ar—8% H_2 bubbled through H_2O, followed by hydrogen reduction to specification O/M in oxygen-gettered Ar-(% H_2 at temperatures ranging from 1200 to 1690°C.

SPENT FUELS REPROCESSING

REFER ALSO TO CITATION(S) 51164, 51177, 51179, 51180, 51184, 51535

51154 (CONF-780330—, pp 113-132) **Once-through fuel cycles.** Till, C.E.; Chang, Y.I. (Argonne National Lab., IL). 1978.

From ASME symposium; Albuquerque, NM, USA (16 Mar 1978).

Once-through fuel cycles, without spent fuel reprocessing and recycling, have been proposed as a proliferation-resistant alternative to the baseline nuclear strategy of LWR—Recycle—LMFBR evolution. Both reoptimization of the LWR once-through cycle and other alternative once-through concepts have been suggested to improve the uranium resource utilization, the most obvious shortcoming of once-through fuel cycles. The fuel utilization characteristics for various once-through cycles and possible improvements are quantified and key technical issues are identified. The implications of the once-through cycle improvements on the uranium resource and nuclear energy supply potential are examined, and it is concluded that once-through cycles neither reduce plutonium production nor provide any lasting promise for energy production.

51155 (GA-A—15343) **HTGR fuel reprocessing pilot plant: results of the sequential equipment operation.** Strand, J.B.; Fields, D.E.; Kergis, C.A. (General Atomic Co., San Diego, CA (USA)). May 1979. Contract AT03-76SF71053. 130p. P 07/MF A01.

The second sequential operation of the HTGR fuel reprocessing cold-dry head-end pilot plant equipment has been successfully completed. Twenty standard LHGTR fuel elements were crushed to a size suitable for combustion in a fluid bed burner. The graphite was combusted leaving a product of fissile and fertile fuel particles. These particles were separated in a pneumatic classifier. The fissile particles were fractured and reburned in a fluid bed to remove the inner carbon coatings. The remaining products are ready for dissolution and solvent extraction fuel recovery.

51156 (NUREG/CR—0866) **Oxide particle size distribution from shearing irradiated and unirradiated LWR fuels in Zircaloy and stainless steel cladding: significance for risk assessment.** Davis, W. Jr.; West, G.A.; Stacy, R.G. (Oak Ridge National Lab., TN (USA)). 22 Mar 1979. Contract W-7405-ENG-26. 43p. (ORNL/NUREG—60). P 03/MF A01.

Sieve fractionation was performed with oxide particles dislodged during shearing of unirradiated or irradiated fuel bundles or single rods of UO_2 or 96 to 97% ThO_2—3 to 4% UO_2. Analyses of these data by nonlinear least-squares techniques demonstrated that the particle size distribution is lognormal. Variables involved in the numerical analyses include lognormal median size, lognormal standard deviation, and shear cut length. Sieve-fractionation data are presented for unirradiated bundles of stainless-steel-clad or Zircaloy-2-clad UO_2 or ThO_2—UO_2 sheared into lengths from 0.5 to 2.0 in. Data are also presented for irradiated single rods (sheared into lengths of 0.25 to 2.0 in.) of Zircaloy-2-clad UO_2 from BWRs and of Zircaloy-4-clad UO_2 from PWRs. Median particle sizes of UO_2 from shearing irradiated stainless-steel-clad fuel ranged from 103 to 182 μm; particle sizes of ThO_2—UO_2, under these same conditions, ranged from 137 to 202 μm. Similarly, median particle sizes of UO_2 from shearing unirradiated Zircaloy-2-clad fuel ranged from 230 to 957 μm. Irradiation levels of fuels from reactors ranged from 9,000 to 28,000 MWd/MTU. In general, particle sizes from shearing these irradiated fuels are larger than those from the unirradiated fuels; however, unirradiated fuel from vendors was not available for performing comparative shearing experiments. In addition, variations in particle size parameters pertaining to samples of a single vendor varied as much as those between different vendors. The fraction of fuel dislodged from the cladding is nearly proportional to the reciprocal of the shear cut length, until the cut length attains some minimum value below which all fuel is dislodged. Particles of fuel are generally elongated with a long-to-short axis ratio usually less than 3. Using parameters of the lognormal distribution deduced from experimental data, realistic estimates can be made of fractions of dislodged fuel having dimensions less than specified values.

51157 Separation of nuclear power from nuclear proliferation. Starr, C. (Electric Power Research Inst., Palo Alto, CA). pp 103-110 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

A successful development of the proposed combination of the Fast Breeder Reactor and the CIVEX fuel reprocessing facility would provide an economical nuclear power source for many centuries which inherently separates nuclear power from the issue of weapons material diversion and proliferation. Further, by so doing, it permits great flexibility in international and national planning for nuclear power, as the issues of fuel dependence and terrorist and subnational diversions disappear. In addition, the expansion of the FBR/CIVEX system would eat into the LWR spent fuel stockpile, diminishing steadily this relatively accessible plutonium source. And finally, a rapid development of the FBR/CIVEX for the above reasons would substantially reduce the worldwide concern as to the adequacy of uranium ore supply. From a historical view, it would restore fast reactor development to the path originally foreseen in the programs of worldwide nuclear energy authorities, including the Atomic Energy Commission during its first two decades of existence.

51158 Precedents for diversion-resistant nuclear fuel cycles. Culler, F.L. Jr. (Electric Power Research Inst., Palo Alto, CA). pp 111-123 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

The urgent need to limit the spread of nuclear weapons and to control the means of production of fissionable material has been the dominant force in the worldwide development of civilian nuclear power. The author follows the historical perspective for institutional control. To improve diversion resistance of the back end of the fuel recycle, the Civex process is proposed. The Civex process does not use new separation process principles or new methods for fuel fabrication. Rather, it is a combination of processes used and partially developed techniques for breeder fuel reprocessing and refabrication. Its characteristics are listed. The process steps and the design knowledge to meet these criteria, and to operate under conditions that provide maximum diversion resistance, can be adaptations of methods studied earlier and, in most cases, used for both military and civilian fuel recycle. The adaptations change the original techniques enough to make the technology different from that used for existing

power reactors. The author discusses tried or partially demonstrated techniques from which Civex has been or could be fashioned. Separation processes discussed are bismuth phosphate; Purex; Thorex; fluoride volatility; pyrometallurgy. The Sol—Gel Uranium—Plutonium Spherepak and Pellet Fuels processes are discussed as candidates for Civex fuel-production methods. The author concludes that, in his opinion, the Civex process is as far as technology can go in the back end of the nuclear fuel cycle from illicit diversion of fissile materials. (MCW)

51159 Fast breeder system concept: a diversion-resistant fuel cycle. Levenson, M.; Zebroski, E. (Electric Power Research Inst., Palo Alto, CA). pp 230-255 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

In the 1940s and 1950s, Redox-type solvent extraction processes were developed so that both uranium of the quality required for diffusion plants and plutonium pure enough for weapons could be recovered. The salting agents used resulted in large waste volumes. The Purex process was then tailored to provide pure plutonium, diffusion-plant-purity uranium, and wastes of very small volume. It was practical to plan on utilizing this existing technology and to make those adjustments necessary to utilize Purex for reprocessing breeder fuel. It has been recognized that the requirements of the breeder reactor fuel cycle are different enough from those of the original programs to warrant the eventual development of a cycle tailored for that objective. Today the requirements arising from world unrest to those arising from technology when setting objectives must be added. This paper addresses this issue - the impact of world unrest on process tailoring. Any sovereign nation making the overt decision to become a weapons owner can probably do so and nothing can be done by means of technology to prevent it. That is an issue for international treaties and agreements. However, two related issues - small bands of terrorists or large terrorist groups can be addressed by technology. The authors set as an objective the tailoring of a process and facility for a breeder reactor fuel cycle that would be proof against terrorist theft and subnational group diversion. The related objective is to demonstrate that the existence in any area of such a diversion-proof civilian reprocessing (Civex) plant would not shorten the time from decision to acquire to time of ownership of pure plutonium. The authors review the Purex flowsheet as it might be applied to breeder reactor fuel. A technical appendix, Co-Processing with Fission Product Denaturing of U—Pu from LMFBR Fuel, is included. (MCW)

TRANSPORT AND STORAGE

REFER ALSO TO CITATION(S) 52071

51160 (ONWI—41) **Storage room design parameters for the ONWI Spent Fuel Disposal Study; nine case studies in salt.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). May 1979. Contract EY-76-C-06-1830. 102p. P 06/MF A01.

Each spent fuel processing option, defined by Bechtel, Inc., is compared with a reference case which considered High-Level Waste from reprocessing with U/Pu recycle and a base case which considered the simple encapsulation of spent fuel assemblies. For each case, a minimum extraction ratio was defined consistent with defined thermal limits, where the extraction ratio is defined as the fraction of excavated area per unit of repository area (area of room/area of room + area of pillar). By minimizing the extraction ratio for a given repository capacity, the excavation costs are reduced, resulting in a significant reduction in overall repository cost. Another benefit is increased repository stability since the supporting pillars now encompass a larger percentage of the total repository area. To determine minimum extraction ratios, thermal analyses were conducted for a repository that would store the waste from the Reference Case, the Base Case, and the other options for spent fuel processing. These analyses determined maximum waste and salt temperatures that would occur in the repository regions in which heat-generating waste was buried for a variety of emplacement configurations. The maximum number of canisters of heat-producing waste stored in each room which does not exceed temperature limitations imposed on the waste and the salt is then determined. Therefore, by maximizing the effective use of the canistered-waste rooms, the number of rooms required for a given waste receipt rate is minimized, and thus the extraction ratio is minimized.

51161 (STUDSVIK-RF—77-2268) **Updating the BEGAFIP code.** Ekberg, K.; Olsson, Goeran. (Aktiebolaget Atomenergi, Studsvik (Sweden)). Mar 1978. 31p. (In Swedish). U 03MF A01.

The computer program BEGAFIP, for calculation of radiation source strengths and heat generation in spent reactor fuel, has been updated. A number of transuranium isotopes not previously considered and their decay chains are now included. A comparison is made to the CASMO program on the production of heavy elements.

51162 Use of a Bayesian reasoning in safety and reliability decisions - three examples. Kaplan, S.; Garrick, B.J. (Pickard, Lowe and Garrick, Inc., Irvine, CA). *Nucl. Technol.;* **44**: No. 2, 231-245(Jul 1979).

Bayes' theorem is used to quantify the impact of new evidence in three energy-related decision problems. The first problem concerns the risk of radioactivity release during the railroad transport of spent nuclear fuel. This history of shipments thus far is shown to make it highly unlikely that the frequency of release is on the order of 10^{-3} or greater per shipment. The second and third applications involve predicting the availability performance of new generations of turbine blades. Bayes' theorem is demonstrated as a means for incorporating in the prediction the limited operational data on the new blades along with the experience of the earlier generation and the knowledge of the design changes.

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 51790

WASTE MANAGEMENT

REFER ALSO TO CITATION(S) 52152

51163 (EUR—5969) **Arisings of cladding wastes from nuclear fuel in the European Community.** Cottone, G. (Commission of the European Communities, Luxembourg). 1978. 16p. U 02/MF A01.

An inquiry has been made in the member states on composition, activation and amounts of cladding wastes arising in the European Community until 1990 from the following reactor types: BWR, PWR, SGHWR, AGR and FBR. The elaborated results of this inquiry are given in this report. On the basis of forecasted reprocessing capacities the cumulative amount of cladding waste in the Community was estimated to reach in 1985 and 1990, respectively, about 2,100 and 7,300 metric tons. This waste will mainly consist of zircaloy and of smaller amounts of stainless steel and nickel alloy. Assuming that 0.5% of the spent fuel remains with the cladding, the contamination has been estimated for cooling times varying from 1 to 1000 years. In the first centuries activation is prevailing, but contamination determines the long-term radioactivity; consequently better decontamination, removing the alpha-bearing compounds, would be beneficial in reducing the long term hazard.

WASTE PROCESSING

REFER ALSO TO CITATION(S) 52188

51164 (HEDL-TME—79-11) **Waste management of mercuric nitrate off-gas scrubber solution: a laboratory study.** Partridge, J.A.; Bosuego, G.P. (Hanford Engineering Development Lab., Richland, WA (USA)). Jul 1979. Contract EY-76-C-14-2170. 38p. P 03/MF A01.

Laboratory studies of a process for volume reduction treatment of a waste mercuric nitrate—nitric acid off-gas scrubber solution containing iodine are reported. Volume reduction is accomplished by evaporation at the boiling point. In order to prevent volatilization of iodine, the process involves feeding the iodine-containing scrubber solution, typically 8 to 10 M in nitric acid, into an evaporator initially charged with concentrated (~ 15.8 M) nitric acid. The iodine is oxidized to nonvolatile iodate under these conditions and precipitates as mercuric iodate. 5 figures, 10 tables.

WASTE DISPOSAL AND STORAGE

REFER ALSO TO CITATION(S) 51160, 51175

51165 (LA—7900-PR) **Research and development related to the Nevada Nuclear Waste Storage Investigations. Progress report, January 1—March 31, 1979.** Crowe, B.M. (comp.). (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG-36. 20p. P 02/MF A01.

The results of research and program development related to the Nevada Nuclear Waste Storage Investigations is presented for Subtasks 3, 2, and 5. Batch sorption measurements have been completed for selected core samples obtained from exploration drill hole UE25A# 1. In general, sorptive properties of the cores are highly favorable for the isotopes studied. Work with tuff is continuing in the areas of crushed rock column studies, sorption ratio studies of U(VI), batch measurements of sorption of ^{241}Am and ^{239}Pu, and

microautoradiographic work. Petrologic characterization of core samples from drill hole UE25A# 1 is completed; x-ray diffraction analyses are in progress. Field investigations of the basalts of Crater Flat are in progress. Areas of investigation include determination of the eruptive history and structural setting of volcanic centers, determination of magnetic polarity and basalt petrology (petrography and microprobe studies of mineral phases). Quality assurance procedures and work plans were processed for G-6 and CNC-11 programs. Requirements for a quality assurance program for the US Geological Survey are being evaluated.

51166 (NUREG/CR—0680) **Evaluation of alternative methods for the disposal of low-level radioactive wastes.** Macbeth, P.; Wehmann, G.; Thamer, B.J.; Card, D.H. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Jul 1979. 178p. (FBDU—209-03). C .

A comparative analysis of the most viable alternatives for disposal of solid low-level radioactive wastes is presented to aid in evaluating national waste management options. Four basic alternative methods are analyzed and compared to the present practice of shallow land burial. These include deeper burial, disposal in mined cavities, disposal in engineered structures, and disposal in the oceans. Some variations in the basic methods are also presented. Technical, socio-political, and economic factors are assigened relative importances (weights) and evaluated for the various alternatives. Based on disposal of a constant volume of waste with given nuclear characteristics, the most desirable alternatives to shallow land burial in descending order of desirability appear to be: improving present practices, deeper burial, use of acceptable abandoned mines, new mines, ocean dumping, and structural disposal concepts. It must be emphasized that the evaluations reported here are generic, and use of other weights or different values for specific sites could change the conclusions and ordering of alternatives determined in this study. Impacts and costs associated with transportation over long distances predominate over differences among alternatives, indicating the desireability of establishing regional waste disposal locations. The impacts presented are for generic comparisons among alternatives, and are not intended to be predictive of the performance of any actual waste disposal facility.

51167 (ORNL—5524) **Cement technology for plugging boreholes in radioactive waste repository sites. Progress report, October 1, 1977—September 30, 1978.** Moore, J.G.; Morgan, M.T.; McDaniel, E.W.; Greene, H.B.; West, G.A. (Oak Ridge National Lab., TN (USA)). Aug 1979. Contract W-7405-ENG-26. 80p. P 05/MF A01.

Experiments are in progress using 34 batches of cements from 13 different locales, representing 11 types of cement, and 17 batches of fly ash from 14 suppliers. Data are being obtained from physical and chemical test methods and from measurements made in parametric studies involving cement—fly-ash concretes and saltcretes. Addition of 10 wt % salt to a standard mortar will double the initial and final set times. The set time of the saltcrete can be increased or decreased by a lignite fly ash or bituminous fly ash respectively. The compressive strengths of mortars were measured at 7, 28, and 91 days. The compressive strengths of cement--fly-ash concretes were found to vary with curing time and the fly ash composition. The strengths of saltcretes decreased with increasing salt concentration but increased with the addition of fly ash; the effect of the fly ash composition was apparently negligible. The thermal conductivities of cementitious solids, were found to increase with density and with sand and/or salt concentration. Thermal conductivities of saltcretes decreased with increasing temperature but remained almost constant in neat cement pastes. The conductivity values ranged from 0.4 W/m.K for a neat cement paste to 1.8 W/m.K for a salcrete. Results for a number of saltcretes under the same drying conditions showed that the apparent liquid permeability decreased with increasing salt content. Shrinkage of neat pastes and saltcretes varied approximately linearly with time, while cement--fly-ash solids showed a high rate in the first few weeks followed by a lower rate for a longer time period.

51168 (PNL—2903) **Evaluation of kriging techniques for high level radioactive waste repository site characterization.** Doctor, P.G. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jan 1979. Contract EY-76-C-06-1830. 87p. P 05/MF A01.

Kriging is a statistical method for estimating functions that describe spatially distributed phenomena such as groundwater elevation and depth to basalt. It produces a contour model of the geologic formation of a potential site with an associated measure of uncertainty, and it can be used to optimize the selection of additional sampling locations. Kriging was applied to water potential data and top-of-basalt elevations from the Hanford site; the computer code BLUEPACK was used to perform the computations. The water potential contours were in close agreement with a hand-drawn contour map which is used as a standard. It is concluded that kriging can be a useful tool for geologic waste repository site characterization. (DLC)

51169 (SAND—79-1113C) **Evaluation of the proposed WIPP site in southeast New Mexico.** Weart, W.D. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 35p. (CONF-790822—7). P 03/MF A01.

From 87. AICHE national meeting; Boston, MA, USA (19 Aug 1979).

Five years of earth science characterization of the proposed Waste Isolation Pilot Plant (WIPP) site provide a high level of assurance that the area is satisfactory for development of a geologic repository. Ecological investigations and socioeconomic studies have indicated only relatively benign impacts will occur from construction, operation and long-term aspects of the repository.

51170 (TID—29018(DRAFT)) **Earth science technical plan for mined geologic disposal of radioactive waste.** (Department of Energy, Washington, DC (USA). Office of Nuclear Waste Management; Geological Survey, Washington, DC (USA)). Jan 1979. 160p. P 08/MF A01.

The major purposes of this report are to formally organize the individual earth-science research tasks directed toward a geologic repository for radioactive waste performed directly or by contract by the US Department of Energy (DOE) and the US Geological Survey (USGS), to show how these tasks address the principal remaining technical questions related to geologic disposal of nuclear waste, to identify technical questions that require additional attention, and to identify priorities for future work. In support of these purposes this report: presents a systematic review and identification of earth-science issues and recommends work that will support site characterization, evaluation, and selection; repository design and operation; and short- and long-term risk assessment. Inventories and classifies current technical R and D to facilitate integration and coordination of DOE and USGS sponsored work. Identifies R and D activities which should be more closely coordinated for timely resolution of technical questions. Specifies technical plans to resolve significant uncertainties regarding mined repositories, as discussed in the Interagency Review Group (IRG) Report to the President and Alternative Technology Strategies for the Isolation of Nuclear-Waste, and other earth science reports.

51171 **Control of stress corrosion cracking in storage tanks containing radioactive waste.** Ondrejcin, R.S.; Rideout, S.P.; Donovan, J.A. (E.I. du Pont de Nemours and Co., Aiken, SC). *Nucl. Technol.;* **44**: No. 2, 297-306(Jul 1979).

At the Savannah River Plant, stress corrosion of carbon steel storage tanks containing alkaline nitrate radioactive waste is controlled by specification of limits on waste composition and temperature. Actual cases of cracking have occurred in the primary steel shell of tanks designed and built before 1960 and were attributed to a combination of high residual stresses from fabrication welding and aggressiveness of fresh wastes from the reactor fuel reprocessing plants. The fresh wastes have the highest concentration of nitrate, which has been shown to be the cracking agent. Also, as the waste solutions age and are reduced in volume by evaporation of water, nitrite and hydroxide ions become more concentrated and inhibit stress corrosion. Thus, by providing a heel of aged evaporated waste in tanks that receive fresh waste, concentrations of the inhibitor ions are maintained within specified ranges to protect against nitrate cracking. Tanks designed and built since 1960 have been made of steels with greater resistance to stress corrosion; these tanks have also been heat treated after fabrication to relieve residual stresses from construction operations. Temperature limits are also specified to protect against stress corrosion at elevated temperatures.

51172 **Radioactive waste management in the United Kingdom.** Keen, N.J. (UKAEA, Harwell. Atomic Energy Research Establishment). pp 46-59 of Geological aspects of uranium in the environment. Duff, P.McL.D. (ed.). London; Geological Society (1978).

From Conference on geological aspects of uranium in the environment; Strathclyde, UK (12 Nov 1977).

A brief outline is given of the nature of radioactive wastes arising from nuclear power generation, the quantities involved and some important aspects of the waste relevant to the discussion of geological aspects of sub-surface disposal of waste. Particular mention is made of the vitrification of highly active waste.

51173 **Geological aspects of disposal of solid, high-level radioactive waste.** Gray, D.A. (Institute of Geological Sciences, London (UK)). pp 63-73 of Geological aspects of uranium in the environment. Duff, P.McL.D. (ed.). London; Geological Society (1978).

From Conference on geological aspects of uranium in the environment; Strathclyde, UK (12 Nov 1977).

Geological factors are identified which lead to the belief that disposal into continental rocks may prove acceptable and the relation of the UK programme to those being mounted in the international field is outlined. The term 'containment' is discussed, and the criteria required to permit the 'containment' of radioactive waste are examined. Host rock selection is considered.

51174 **Proving a potential site for the geological disposal of high-level radioactive waste.** Mather, J.D. (Institute of Geological Sciences, Harwell (UK). Environmental Pollution Section). pp 74-80 of

Geological aspects of uranium in the environment. Duff, P.McL.D. (ed.). London; Geological Society (1978).

From Conference on geological aspects of uranium in the environment; Strathclyde, UK (12 Nov 1977).

Assuming a potentially suitable site has been selected and that a particular site has been identified within this area, what research is required to prove that the geological formations at this site can isolate the waste from man's environment over the time scale required. The main UK research effort at present involves the possible disposal to crystalline rock formations and it is suggested that work in the UK should examine, at least at the reconnaissance level, the relevant properties of Caledonian granites, Lewisian basement, and Moine migmatites. The main research headings are: (1) 3-dimensional characterisation of the repository volume; (2) groundwater movement; (3) effects of fission-product heating; (4) rock mechanics; (5) seismicity; (6) waste/rock interactions; (7) sealing of repository and investigatory boreholes, and (8) modelling and the prediction of future geological events.

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 52152, 52154, 52188, 52219

51175 Migratory properties of some nuclear waste elements in geologic media. Seitz, M.G.; Rickert, P.G.; Fried, S.; Friedman, A.M.; Steindler, M.J. (Argonne National Lab., IL). *Nucl. Technol.;* **44**: No. 2, 284-296(Jul 1979).

To aid in assessing the suitability of geologic disposal, the authors have examined the interactions of trace quantities of cesium, plutonium,, neptunium, and americium in aqueous solutions with rocks from formations that may be suitable for waste repositories. Results indicate that many geologic formations are barriers to the movement of these elements in flowing water. However, reactions that retard element migration are varied and do not lend themselves to simplified descriptions. In experiments with plutonium and americium, kinetics of reactions were seen to differ for each trace element and rock studied. In rock infiltration experiments with radioactive cesium, plutonium, neptunium, and americium, often most of the activity moved slowly compared to the water stream, but small quantities of the trace elements moved downstream from the main peaks of activity because of the slow reaction rates seen in static experiments, or possibly because of multiple speciation, colloid formation, movement of particles with adsorbed nuclides, or other causes. 2 figures, 7 tables.

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 51162, 51721, 51722, 52209

REGULATIONS

ACCOUNTABILITY AND SAFEGUARDS

REFER ALSO TO CITATION(S) 52025

51176 (AD-A—060791) **A vhf intrusion detection technique for isolated resources.** Karas, N.V.; Poirier, J.L.; Antonucci, J.A.; Szczytko, M. (Rome Air Development Center, Griffiss AFB, NY (USA)). Jul 1978. 41p. Y A03/MF A01.

A mobile rf intruder detection system for isolated or clustered high value resources has been successfully tested. Because the system operates in the very high frequency (VHF) range, there is little shadowing from aircraft or vehicle structures. Also, since human body size is comparable to the wavelength at these frequencies, the electromagnetic fields interact strongly with intruders. This response makes detection easier and helps to eliminate false alarms caused by small animals, wind-blown debris, and other similar objects. The experimental results show that the technique has a low false-alarm rate and a high detection sensitivity. (Author)

51177 (CONF-780330—) **Non-proliferation: reality and illusion of a plutonium-free economy.** (American Society of Mechanical Engineers. New Mexico Section). 1978. 224p. ASME New Mexico Section, P.O. Box 5392, Albuquerque, NM $10.00.

From ASME symposium; Albuquerque, NM, USA (16 Mar 1978).

A separate abstract was prepared for each of 14 of the 16 presentations; two papers were processed earlier. All of the 14 papers of the proceedings will appear in Energy Abstracts for Policy Analysis (EAPA); four of the papers plus the two papers processed earlier will appear in Energy Research Abstracts (ERA).

51178 (CONF-780330—, pp 91-112) **Characteristics of nonproliferating fuel cycles.** Kendrick, H.; Tooper, F.E.; Straker, E.A. 1978.

From ASME symposium; Albuquerque, NM, USA (16 Mar 1978).

The reason for analyzing alternative fuel cycles is to identify those characteristics which provide weak links and to develop a balanced fuel cycle in which neither the front end, the reactor, nor the back end would provide an obvious pathway to a nuclear weapons capability. This balance can be achieved with identifiable technical, institutional, and political barriers. The economics, safety, environmental, and commercial feasibility of the barriers must also be evaluated to assess national and international acceptability. The choice between systems should be based on these factors in addition to the problem of proliferation.

51179 (CONF-780330—, pp 179-186) **International institutions for nuclear energy: issues of assessment and design.** Harris, W.R. (Rand Corp., Santa Monica, CA). 1978.

From ASME symposium; Albuquerque, NM, USA (16 Mar 1978).

Among the more attractive of candidate institutions and rules-of-trade for advanced fuel cycles are: extension of full-scope International Atomic Energy Agency (IAEA) safeguards as a condition of fuel assurances or technology transfer; international jurisdiction over spent fuel (custody or ownership); an IAEA remote near-real-time verification system for spent fuel remaining under national management; a convention on uniform nuclear fuel identification (tagging) designed to assist safeguards planners, trace diversionary pathways, assign liability, and enhance the credibility of fuel-cycle sanctions; international nuclear service centers for bulk processing operations (heavy water production, enrichment and reprocessing); and fuel-cycle specific regulations. Some risk-reduction measures, for example on internationally managed, remote shutdown and restart-delay system for bulk processing facilities, raise questions of acceptability. Despite uncertainties about international acceptability and hazards of enrichment technology transfer later in this century, it appears feasible to reduce proliferation risks associated with nuclear fuel cycles - existing ones and those under review within the International Nuclear Fuel Cycle Evaluation (INFCE). 6 refereces.

51180 (CONF-790707—17) **Real time material accountability in a chemical reprocessing unit.** Morrison, G.W.; Blakeman, E.D. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 11p. P 02/MF A01.

From 20. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (16 Jul 1979).

Real time material accountability for a pulse column in a chemical reprocessing plant has been investigated using a simple two state Kalman Filter. Operation of the pulse column was simulated by the SEPHIS-MOD4 code. Noisy measurements of the column inventory were obtained from two neutron detectors with various simulated counting errors. Various loss scenarios were simulated and analyzed by the Kalman Filter. In all cases considered the Kalman Filter was a superior estimator of material loss.

51181 (CONF-790707—22) **Material control test and evaluation system at the ICPP.** Johnson, C.E. (Allied Chemical Corp., Idaho Falls, ID (USA). Idaho Chemical Programs - Operations Office). 1979. Contract EY-76-C-07-1570. 13p. P 02/MF A01.

From 20. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (16 Jul 1979).

The US DOE is evaluating process monitoring as part of a total nuclear material safeguards system. A monitoring system is being installed at the Idaho Chemical Processing Plant to test and evaluate material control and surveillance concepts in an operating nuclear fuel reprocessing plant. Process monitoring for nuclear material control complements conventional safeguards accountability and physical protection to assure adherence to approved safeguards procedures and verify containment of nuclear materials within the processing plant.

51182 (CONF-790707—23) **Applying new safeguards technology to existing nuclear facilities.** Harris, W.J.; Wagner, E.P. (Allied Chemical Corp., Idaho Falls, ID (USA). Idaho Chemical Programs - Operations Office). 1979. Contract EY-76-C-07-1570. 17p. P 02/MF A01.

From 20. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (16 Jul 1979).

The application and operation of safeguards instrumentation in a facility containing special nuclear material is most successful when the installation is desinged for the operation of the specific facility. Experience at the Idaho National Engineering Laboratory demonstrates that installation designs must consider both safeguards and production requirements of specific facilities. Equipment selection and installation design influenced by the training and experience of production operations and safeguards personnel at a specific facility help assure successful installation, reliable operation, and

minimal operator training. This minimizes impacts on existing plant production activities while maximizing utility of the safeguards information obtained.

51183 (DOE/DP—0001-4) **Semi-annual report on strategic special nuclear material inventory differences.** (Department of Energy, Washington, DC (USA). Office of Safeguards and Security). Jul 1979. 25p. P 02/MF A01.

This report provides and explains the generally small differences between the amounts of nuclear materials charged to DOE facilities and the amounts that could be physically inventoried. This report covers data for the period from April 1, 1978, through September 30, 1978, and includes accounting corrections for data from earlier periods. These data and explanations, together with the absences of physical indications of any theft attempt, support a finding that during this period no theft or diversion of a significant amount of strategic special nuclear materials has occurred.

51184 (LA—7521) **Coordinated safeguards for materials management in a uranium—plutonium nitrate-to-oxide coconversion facility: Coprecal.** Dayem, H.A.; Cobb, D.D.; Dietz, R.J.; Hakkila, E.A.; Kern, E.A.; Schelonka, E.P.; Shipley, J.P.; Smith, D.B. (Los Alamos Scientific Lab., NM (USA)). Feb 1979. Contract W-7405-ENG-36. 186p. P 09/MF A01.

This report describes the conceptual design of an advanced materials-management system for safeguarding special nuclear materials in a uranium—plutonium nitrate-to-oxide coconversion facility based on the Coprecal process. Design concepts are presented for near real-time (dynamic) accountability by forming dynamic materials balances from information provided by chemical and nondestructive analyses and from process-control instrumentation. Modeling and simulation techniques are used to compare the sensitivities of proposed dynamic materials accounting strategies to both abrupt and protracted diversion. The safeguards implications of coconversion as well as some unique features of the reference process are discussed and design criteria are identified to improve the safeguardability of the Coprecal coconversion process.

51185 (LA—7882-MS) **Experimental comparison of the active well coincidence counter with the random driver.** Menlove, H.O.; Ensslin, N.; Sampson, T.E. (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 28p. P 03/MF A01.

A direct comparison has been made between the IAEA Active Well Coincidence Counter (AWCC) and the CMB-8 Random Driver. The comparison included an experimental evaluation of precision, counting rate, accuracy, penetrability, stability, and the effect of sample inhomogeneity. Samples used in the evaluation included highly enriched U_3O_8, U_3O_8 mixed withe qgraphite, highly enriched uranium metal discs, and depleted uranium metal. These materials are typical of the samples of interest to the IAEA inspectors. It was concluded that the two instruments had very similar performance characteristics with the Random Driver giving better penetrability and the AWCC giving better stability.

51186 (NUREG/CR—0960) **Safeguards Network Analysis Procedure (SNAP): overview.** Chapman, L.D; Engi, D. (Sandia Labs., Albuquerque, NM (USA)). Aug 1979. Contract EY-76-C-04-0789. 22p. (SAND—79-0438; CONF-790707—15). P 02/MF A01.

From 20. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (16 Jul 1979).

Nuclear safeguards systems provide physical protection and control of nuclear materials. The Safeguards Network Analysis Procedure (SNAP) provides a convenient and standard analysis methodology for the evaluation of physical protection system effectiveness. This is achieved through a standard set of symbols which characterize the various elements of safeguards systems and an analysis program to execute simulation models built using the SNAP symbology. The outputs provided by the SNAP simulation program supplements the safeguards analyst's evaluative capabilities and supports the evaluation of existing sites as well as alternative design possibilities. This paper describes the SNAP modeling technique and provides an example illustrating its use.

51187 (RHO-ST—22) **High-accuracy determination of uranium in concentrated, relatively pure solutions of uranyl nitrate.** Jewett, J.R. (Atomics International Div., Richland, WA (USA). Rockwell Hanford Operations). Dec 1978. Contract EY-77-C-06-1030. 29p. P 03/MF A01.

A highly accurate gravimetric assay procedure has been developed and evaluated to verify uranium concentrations in standard solutions of uranyl nitrate. This procedure, based on quantitative conversion of uranium to stoichiometric U_3O_8, has been shown to yield a relative precision of +-0.08% for a single determination at the 95% confidence limit. No bias can be detected.

51188 (Y/DG—10-746) **Progress report on installing DYMCAS in the Oak Ridge Y-12 Plant.** Mee, W.T. (Oak Ridge Y-12 Plant, TN (USA)). 1979. Contract W-7405-ENG-26. 8p. (CONF-790707—1). P 02/MF A01.

From 20. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (16 Jul 1979).

A material control and accountability system to assist in detecting diversion of special nuclear materials (SNM) was being considered by the management of the Oak Ridge Y-12 Plant in early 1975. The Dynamic Special Nuclear Materials Control and Accountability System (DYMCAS) is the product of these considerations. The evolution of computerized accountability systems for near real-time accounting of SNM will revolutionize the activities for operations and accountability departments in Y-12. The advancement of nondestructive analysis equipment with a capability for real-time input of accounting data is becoming a reality. The progress of installing the DYMCAS in a large plant processing unirradiated enriched uranium is described.

FUSION FUELS

PROCESSING

FABRICATION AND TESTING

51189 (UCRL—82408) **Full surface examination of small spheres with a computer controlled scanning electron microscope.** Ward, C.M.; Willenborg, D.L.; Montgomery, K.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 Feb 1979. Contract W-7405-ENG-48. 11p. (CONF-790813—4). P 02/MF A01.

From 14. annual meeting of the Microbeam Analysis Society; San Antonio, TX, USA (13 Aug 1979).

This report discusses a computer automated stage and Scanning Electron Microscopy (SEM) system for detecting defects in glass spheres for inertial confinement laser fusion experiments. This system detects submicron defects and permits inclusion of acceptable spheres in targets after examination. The stage used to examine and manipulate the spheres through 4π steradians is described. Primary image recording is made on a roster scanning video disc. The need for SEM stability and methods of achieving it are discussed.

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

RADIATION SOURCES

OTHER INDUSTRIAL USES

REFER ALSO TO CITATION(S) 52085

51190 (AD-A—060590) **Erosivity of a nitramine propellant. Technical report.** Greene, R.W.; Ward, J.R.; Brosseau, T.L.; Niiler, A.; Birkmire, R. (Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.). Aug 1978. 32p. Y A03/MF A01.

To achieve extended ranges with lightweight guns, the Army uses propellants with flame temperatures greater than 3000K. Such propellants erode gun steel, leading to undesirably short wear lives. One solution to this problem is development of propellants with comparable performances and lower flame temperatures. Nitramine-containing propellants offer such possibilities, but previous experiments indicated the nitramine propellants were more erosive than conventional propellants. In view of the need for high-force, low-flame temperature propellants, it was important to re-examine the earlier unexpected results. A series of experiments was conducted in a 37mm blow-out gun with a high impetus nitramine propellant containing 37-percent RDX and four standard Army propellants: M1, M30, M5, and M8. The nitramine propellant has a flame temperature about the same as M5 and an impetus slightly greater than M8 propellant. The erosivities of the five propellants were measured by mass loss of a contoured nozzle. A radioactive technique was also used which measured the amount of wear of the contoured nozzle.

51191 (COO—2155-21) **Biomedical engineering support. Final report, June 15, 1971—June 30, 1979.** Kolff, W.J.; Sandquist, G.; Olsen, D.B.; Smith, L.M. (Utah Univ., Salt Lake City (USA). Inst. for Biomedical Engineering). 1979. Contract EY-76-S-02-2155. 173p. P 08/MF A01.

On June 15, 1971 the Institute for Biomedical Engineering at the University of Utah contracted with the USAEC to provide biomedical support for an Artificial Heart Program. The goal of the program was to conceive, design, construct and test a prototype artificial heart system powered by an implantable radioisotope heat

source. The system would serve as a total artificial heart for animal experiments and for studies directed at developing a total heart replacement system for humans. The major responsibilities of the Institute during the eight year contract period were to design, construct and test all blood handling components of the system and prove in vivo accommodation, performance and adequacy of the system in experimental animals. Upon completion of development of the Implantable Version of the Bench Model Blood Pump, a long series of comprehensive in vitro and in vivo experiments were conducted. In vivo experiments with the system conducted in calves demonstrated the general accommodation, adequate performance and good capacity to sustain the calf as a heart model for up to 36 days. During the more successful in vivo experiments the implanted calves were able to eat, drink, stand, exercise on a treadmill, and exhibited normal blood chemistry and pulmonary function.

ISOTOPIC POWER SUPPLIES

REFER ALSO TO CITATION(S) 51936

DESIGN AND FABRICATION

51192 (LA—7952-PR) **General-purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program. Progress report, May 1979.** Maraman, W.J. (comp.). (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG-36. 43p. P 03/MF A01.

The formal monthly report covers the studies related to the use of $^{238}PuO_2$ in radioisotopic power systems carried out for the Advanced Nuclear Systems and Projects Division of the Los Alamos Scientific Laboratory. Research progress is reported on: (1) General-Purpose Heat Source Development; (2) Space Nuclear Safety; and (3) Radioisotopic Terrestrial Safety.

51193 (ORNL/TM—6887) **Testing of bellows for engineering systems. Part 1.** McCoy, H.E. Jr. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 43p. P 03/MF A01.

Bellows made of Hastelloy X and Type 347 stainless steel will be used in the Brayton Isotope Power System (BIPS). Development of this system will involve the Work Horse Loop (WHL) and the Ground Demonstration System (GDS). The primary function of these bellows is to accommodate relative movement of parts of the system, which results from differential temperatures. Methods for performing several types of tests on metal bellows have been developed. Three Hastelloy X bellows were subjected to low-cycle fatigue tests, and their failure times were very close to those predicted by the designer. The failures were largely intergranular and typical of the type expected at elevated temperatures.

HYDROGEN

STEAM REFORMER PROCESSES

REFER ALSO TO CITATION(S) 51840

PROPERTIES

REFER ALSO TO CITATION(S) 51967

51194 (AD-A—060400) **Kinetics of hydrogen-oxygen and hydrocarbon-oxygen reactions. Interim report, 1 April 1977-30 June 1978.** Baldwin, R.R.; Walker, R.W. (Hull Univ. (UK). Dept. of Chemistry). Jun 1978. 18p. Y A02/MF A01.

Refinement of the rate constans obtained from studies of the H_2+O_2 reaction at 500 C has continued. Rate constants for the reactions of H atoms and OH radicals with C_2-C_5 alkanes have been refined, and Arrhenius parameters obtained. New studies have been made of the addition of 2,2,3,3-tetramethylbutane and 2,2,3-trimethylbutane to slowly reacting mixtures of H_2+O_2 at 480 C. The mechanism of CO_2 formation in propionaldehyde oxidation, and of acetone formation in isobutyraldehyde oxidation at 440 C has been examined. Rate constants have been obtained for the initiation process and for attack of HO_2 at the various C-H bonds. The homogeneous decomposition of 2,2,3,3-tetramethylbutane (TMB) in the presence of O2 has been shown to be an excellent source of HO_2 radicals, and preliminary rate constants have been obtained for HO_2+TMB, and $HO_2+C_2H_6$ at 440 C. Interpretation of the N_2O+H_2 reaction continues.

OTHER SYNTHETIC AND NATURAL FUELS

PREPARATION

CHEMICAL SYNTHESIS

REFER ALSO TO CITATION(S) 50951

51195 (COO—4507-4) **Arc—Coal Acetylene Process Development Program. Quarterly technical progress report No. 4, October 1—December 31, 1978.** (Avco Systems Div., Wilmington, MA (USA)). 10 Jan 1979. Contract EM-78-C-02-4507. 29p. P 03/MF A01.

Data taken from the Avco 200 kw Arc Coal Reactor facility provides increasing optimism for this acetylene producing process. Continued improvements in the reactor design have been accomplished over the past three months. These improvements result in data which, when reduced and analyzed, yield SER's well below 5.0. Further, these SER values are an improvement over those of the comparable OCR program test data results under the same test conditions. The anode and cathode designed for this 200 kw Chemical Facilities have performed well with no visible degradation after minor adjustments in the geometry and operating procedures. The data taken to date, both with and without quench, within this facility underline the importance of commencing work on the 1 Mw Arc Coal Acetylene PDU where SER values between 3.5 and 4.0 are a clear probability. With values of SER in this range, the arc coal process is economically attractive as a competitor to the ethylene process for manufacturing vinyl chloride monomer and vinyl acetate monomer. A summary of the 200 kw facility test results in Appendix A is a synopsis of a Topical Technical Report submitted earlier.

PREPARATION FROM WASTES OR BIOMASS

REFER ALSO TO CITATION(S) 51003, 51262, 51831

51196 (SERI/TP—49-183, pp 3.1-3.30) **Gasification: an overview.** Overend, R. 1979.

From Biomass gasification workshop; Seattle, WA, USA (2 Feb 1979).

In this wide-ranging overview of biomass gasification the topics discussed include a description of the mechanisms of wood gasification; gasifier configurations, design, performance, and construction; and present and future applications. (JSR)

51197 (SERI/TP—49-183, pp 4.1-4.16) **History and potential of air gasification.** Horsfield, B.C. (Weyerhaeuser Co., Tacoma, WA). 1979.

From Biomass gasification workshop; Seattle, WA, USA (2 Feb 1979).

A brief review is given of the development of gasification in Europe, the primary gasifier designs used, and the development of gas producers for automotive engines. Current research on gasifiers in England, France, and Sweden is discussed. The discussion of potential for air gasification of biomass considers the advantages and disadvantages and tabulates some specific industrial applications. (JSR)

51198 (SERI/TP—49-183, pp 5.1.1-5.1.10) **Downdraft gasifier.** Goss, J.R. (Univ. of California, Davis). 1979.

From Biomass gasification workshop; Seattle, WA, USA (2 Feb 1979).

The state of the gasification art and the gasification process are briefly discussed with emphasis on the downdraft gasifier. The development and description of the UCD/SERCDC pilot plant downdraft gas producer are presented. Some design particulars are given but construction details have been omitted. The gas producer has been operated for a total of 705 hours, 328 1/2 of which were continuous. Fifteen observed and calculated data items are presented for two 12 hour periods and one 3.8 hour period when wood chips were gasified at 453, 678, and 682 pounds wet weight/hour. Calculated heat output in the hot gas stream was 2.7 and 4.4 million Btu/hr. Process energy transfer efficiency from fuel to hot gas ranged from 82.8 to 84.7 percent. Heating value of the gas ranged from 184 to 190 Btu/ft^3 (NTP).

51199 (SERI/TP—49-183, pp 5.2.1-5.2.12) **Gasification systems: a case history.** Fernie, A.D. (Westwood Polygas Ltd., Vancouver, British Columbia). 1979.

From Biomass gasification workshop; Seattle, WA, USA (2 Feb 1979).

The gasification system - case history pertains to the Westwood Polygas full-scale prototype plant located at Ainsworth Lumber Company in Chasm, British Columbia, Canada. This plant has, over the past three years, operated periodically for a total of one thousand hours and has undergone modifications to overcome many operating difficulties. The gasifier is a fixed bed system, air blown with some steam addition for combustion zone control and water gas production. The flow of air/gas is counter-current to the vertical gravity fuel bed. A saturated cool 140 to 160 Btu gas is taken off the reactor vessel top. The gasifier is simple, requiring no auxiliary fuels, special subsystems or expensive fuel preparation and can be operated by mill personnel. The Westwood Polygas process and the Ainsworth gasifier are in the last stages of a Canadian Government assisted research program and by mid-1979 Westwood Polygas hopes to have developed a process and necessary hardware technology for building a commercial fixed-bed gasifier.

51200 (SERI/TP—49-183, pp 5.3.1-5.3.13) **Fluidized bed gasifiers.** Assaly, R. (Alberta Industrial Developments Ltd., Edmonton, Canada). 1979.
From Biomass gasification workshop; Seattle, WA, USA (2 Feb 1979).

The Thermex-Reactor, a fluidized-bed gasification process, is a commercially available system using advanced technology so that either the producton of gas or charcoal can be maximized. The principles of the process are described. System components, reactor performance, operational systems, and capital and operating costs are tabulated. (JSR)

51201 (SERI/TP—49-183, pp 5.4.1-5.4.10) **Recent operating experience with a small down-draft wood gas generator.** Doner, D.M.; Bailie, R.C. (Environmental Energy Engineering, Morgantown, WV). 1979.
From Biomass gasification workshop; Seattle, WA, USA (2 Feb 1979).

Hardwood blocks, softwood blocks, wood pellets, and charcoal were gasified using various oxygen-air mixtures. The gasifier system used was a Swedish Hessleman Model 50/13 generator. The unit ran on all feeds and oxygen concentrations from 21% (air) to 100% without alteration. The gas produced was burned in a standard North American industrial burner with no modifications. It was also used to fuel a modern Datsun 510 (100 hp.) internal combustion engine. The heating value of the gas produced ran 110^+, 200^+, 260^+ Btu/ft^3 (4.10×10^6, 7.45×10^6, 9.69×10^6 joules/m^3) for oxygen concentrations of 21, 50, and 100%. Compared to the up-draft gas generator the down-draft generator produces a gas containing less liquid and tar products; is considerably smaller for the same output: (3×10^6 Btu/ft^3 reactor volume (112×10^9 joules/m^3) and 3×10^6 Btu/ft^2 of hearth (34×10^9 joules/m^2); and is as efficient for close coupled systems. It can be mass produced at modest cost for 20 to 500 hp engines (14,500 to 363,000 watts) and 50,000 to 1250,000 Btu/hr burners (14,500 to 363,000 watts). Some modifications are necessary for a continuous feed system.

51202 (SERI/TP—49-183, pp 5.5.1-5.5.8) **Vehicle gasifiers.** Johansson, E. 1979.
From Biomass gasification workshop; Seattle, WA, USA (2 Feb 1979).

The pioneer work of the use of producer gas as a fuel for internal combustion engines was carried out in Great Britain, Germany and France. Basic research work in the design of gasifiers was done during world war I Mr. Axel Swedlund in Sweden. The most important feature of the producer gas in Sweden is to serve as a fuel substitute at a shortage in the supply of liquid fuel. Recent research and development work at the National Swedish Testing Institute for Agricultural Machinery has been devoted to the converting of the generators to suit modern diesel engines and to improve the gas cleaners.

51203 (SERI/TP—49-183, pp 8.1-8.16) **Technology and economics of close-coupled gasifiers for retrofitting gas/oil combustion units to biomass feedstock.** Reed, T.B.; Jantzen, D.E.; Corcoran, W.P.; Witholder, R. (Solar Energy Research Inst., Golden, CO). 1979.
From Biomass gasification workshop; Seattle, WA, USA (2 Feb 1979).

Close-coupled air gasifiers can be used to convert existing gas/oil boilers to burn biomass. The gasifiers are relatively simple units operating at 85 to 90% thermal efficiency. The gas contains CO, H_2, hydrocarbon gases and vapors with N_2, H_2O, and C_2O dilutents, and has a heating value of 140 to 200 Btu/scf when burned hot without scrubbing. Use of this gas in existing boilers may cause 5 to 10% derating. Recent tests of a 14 MBtu/hr gasifier coupled to a power boiler in California over a 158 hour period gave satisfactory results with low emissions and only minor technical difficulties. The economics of two gasifiers reported in the literature are analyzed with respect to fuel cost as a function of capital and operating costs. The gas is estimated to cost $1.40 to $2.70/MBtu for biomass feedstocks costing $10 to $20/dry ton. The capital costs of retrofitting existing gas/oil boilers are approximately two-thirds the cost of new installations of package wood-fired boilers. Although gasifiers larger than 100 MBtu/hr are not now available, they could probably be used to convert larger field-erected boilers to biomass more economically than construction of new wood-fired boilers. The cost of construction of a new wood-fired package boiler is estimated to be about the same as the cost of a gasifier plus a conventional gas/oil package boiler.

51204 **Secondary reaction kinetics of pyrolytic volatiles from pelletized wood wastes with steam.** Antal, M.J. Jr. (Princeton Univ., NJ); Reed, T.B. *Prepr., Div. Pet. Chem., Am. Chem. Soc.;* **23**: No. 4, 1323-1328(Sep 1978). (CONF-780902—P4).
From American Chemical Society meeting; Miami, FL, USA (10 Sep 1978).

Previous research at Princeton has shown pyrolylsis/steam reforming of biomass materials to be a two step process. At relatively low temperaturess (300° to 500°C) biomass pyrolyzes, producing a char and volatiles. At somewhat higher temperatures (550° to 700°C) the volatiles react with steam to produce a hydrocarbon rich synthesis gas. Oil and tar production is greatly reduced by the steam reforming step; however, some water soluble compounds (methanol, acetaldehyde, etc.) remain. At significantly higher temperatures the water gas reaction can be used to gasify the char residue, but the demanding conditions required make char gasification of lesser interest in the design of an economical gasifier. In this paper we examine the influence of temperature and residence time on the secondary, gas phase reactions of pyrolysis volatiles from red alder pellets with steam. The data presented is sufficient to define measured rates of gaseous species production for CO, CO_2, H_2, CH_4, C_2H_4, C_2H_6, C_3H_6, and C_3H_8. Somewhat more data is needed to identify reaction mechanisms, activation energies, orders, and other reaction parameters. Of the conditions studied, residence times of 6 to 9 seconds at 700°C produces the largest quantity of medium Btu gas from the pellets. The quantity of gas produced is less than one-half that obtained from cellulose under similar conditions. This relative paucity of gas yield may be an artifact of the pelletizing process, or it may reflect an inherent difficulty in gasifying red alder wood. Of course, more extreme conditions than those examined here could be used to obtain higher gas yields. However, the high cost of reactors utilizing extreme conditions mitigates against their use for biomass gasification. More research is needed to determine the desirability of pelletized fuels for gasification processes, and the optimal conditions for steam pyrolysis/gasification of biomass.

ALCOHOL FUELS

51205 (HCP/M2098—03) **Status of alcohol fuels utilization technology for stationary gas turbines.** (Mueller Associates, Inc., Baltimore, MD (USA)). Apr 1979. Contract EX-76-C-01-2098. 35p. P 03/MF A01.

The primary objectives of the study were to: (1) determine if sufficient work has been performed in order to establish the feasibility of alcohols as fuels for stationary gas turbines, (2) determine if the status of technology has been defined regarding modifications necessary to convert existing stationary gas turbines for operation with alcohol fuels, and (3) determine if the status of technology has been defined for the design of new stationary gas turbines operating on alcohol fuels. Study results are presented in a format which first describes the test work performed and subsequently characterizes the status of alcohol fuels technology (relative to stationary gas turbines) based on this test work. The final chapter of this report presents an overview of various factors that, from a systems viewpoint, would need to be considered if a serious effort were made to utilize alcohols as fuels for stationary gas turbines.

PREPARATION

CHEMICAL SYNTHESIS

REFER ALSO TO CITATION(S) 52053

51206 **Novel interpretations of carbon oxide reduction reactions. II. Over metal oxides.** Sapienza, R.S.; Spaulding, L.D.; Lynch, J.R.; Sansone, M.J. (Brookhaven National Lab., Upton, NY). *Prepr., Div. Pet. Chem., Am. Chem. Soc.;* **23**: No. 4, 1336-1339(Sep 1978). (CONF-780902—P4).
From American Chemical Society meeting; Miami, FL, USA (10 Sep 1978).

Some catalysts have a tendency to produce oxygenated organic products from carbon monoxide and hydrogen. These catalysts generally consist of metal oxides not reduced to metals under

the conditions of the reaction. The mechanism also relates to the methanol and methanol related (e.g., isosynthesis) syntheses. This scheme will also explain the higher yields of oxygenated products found with certain metal catalysts. These products form via the associative adsorption of carbon monoxide on the oxygen of the metal oxide surface, followed by reduction with metal activated hydrogen according to the reaction sequence given. Corroborative findings can be found in certain surface studies. Amberg has shown with infrared spectra that carbon monoxide chemisorbed on zinc oxide at 155°C does not exist as such on the surface, but is immediately oxidized to CO_2. This is also in agreement with various studies of the metal catalyzed oxidation of carbon monoxide which have shown that oxidation occurs after formation of a surface oxide. The strong activated adsorption of CO on a metal oxide can only be removed as CO_2 and this chemisorption is not affected by oxygen pretreatment. In the Fischer—Tropsch reaction the oxide surface is formed by the carbon monoxide dissociation. It has been shown that oxygen pretreatment of the metal surface of a Fischer—Tropsch catalyst will alter the product distribution for a short period with methanol and other oxygenates forming. The consequences of this proposed mechanism are many.

PREPARATION FROM WASTES OR BIOMASS

REFER ALSO TO CITATION(S) 51263

SOLID WASTE FUELS

51207 (STU—76-3449) **Pressing of bark.** Soederman, G.; Englesson, T.; Graernings, L. (Styrelsen foer Teknisk Utveckling, Stockholm (Sweden)). Apr 1978. 30p. (In Swedish). U 03/MF A01.

Due to the development within the forestry industry the barking is mostly performed at the factories. The amount of bark at the factories has also increased due to the fact that most of the transportation is by heavy vehicles instead of by floating. The bark is used as fuel. The energy efficiency is dependent on the dryness of the bark. An incrase of the dryness will increase the heat effect drastically. The dryness of the bark could be increased by pressing or by flue gas drying. The report includes literature studies of assortments and quantities of bark as well as of moisture pickup of the bark and an attempt to determine the amounts of free and bound water, respectively. Pieces of bark have been pressed in order to determine the drynesses obtained at different pressures.

HYDRO ENERGY

REFER ALSO TO CITATION(S) 51269

RESOURCES AND AVAILABILITY

REFER ALSO TO CITATION(S) 51336

51208 (PB—288356) **Optimization of real-time hourly operations of a complex, multiple purpose reservoir system.** Yeh, W.W.G.; Becker, L.; Chu, W. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). Feb 1978. Contract DI-14-34-0001-6209. 218p. Y A10/MF A01.

An hourly optimization model has been developed for on-line use in the operation of the Central Valley Project (CVP) in California. The procedures which are used for optimization are applicable to other water resource systems, although program details must necessarily be changed. The hourly program is supplemental to monthly and daily optimization programs previously developed by the Principal Investigator and his co-workers for the CVP, and maximizes a weighted summation of generated power over a 24-hour period subject to specified plant releases obtained from a daily program, a desired hourly power schedule, and appropriate system and equipment constraints. The procedure has been developed in two phases. Phase I involves a determination of a good feasible policy (a set of releases) through an iterated linear programming and adjust process. Phase II uses this feasible policy as a starting policy in an incremental dynamic programming, successive approximations process to derive an optimal policy. CVP operational records of some typical days have been compared with the program outputs for these days, and significant improvements are observed, both in better conformance with the desired (Pacific Gas and Electric Co.) power schedule and more efficient hydropower production. (Portions of this document are not fully legible)

POWER CONVERSION SYSTEMS

51209 **Power generation using thermal vapor pumping and hydro-pumped storage (thermal gradient utilization cycle)(TGUC).** Parker, S.A. pp 786-795 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Thermal Vapor Pumping can be used to store hydro-power. In Western Europe hydro-pumped storage accounts for 10% of the electric power generation. In the United States, as of 1975, 11,000 MW or 3% of the power produced comes from pumped storage. By 1990 the projections, for pumped storage, using conventional fuels are increased from 3% in the United States to approximately 10% to 20%. However, using a new power plant concept, using thermal vapor pumping (a major feature of the TGUC) it is possible that by 1990 pumped storage or a modification might reach from 30% to 40% of yearly generated power. Part of this projected increase is based on underground pumped storage development, which is enhanced by the use of thermal vapor pumping due to the natural thermal gradient in such a system. One should not confuse TGUC with the vertical temperature gradient found in the oceans. The distinguishing difference being, that in the oceans the thermal gradient is warmest at the top of the ocean surface, and becomes colder as one goes deeper in the ocean, some 4000 feet. as defined by d'Arsonval, and later work by Claude. TGUC uses the vertical temperature difference in our atmosphere, in which the air is warmest at the ground surface and becomes cooler as one goes higher above ground level. Likewise, the earth's crust is cooler at the surface, and becomes warmer as one descends toward the center of the earth. Other distinguishing features are, that all of D'Arsonval's and Claude's work used the conventional Rankine Cycle, (power derived from superheated vapor) where TGUC by Parker derives it's power from a hydrocycle. TGUC is a closed looped system using thermal vapor pumping to a higher elevation where it is condensed and power is derived by a conventional hydro-prime mover along with a conventional regenerative Rankine Cycle.

SOLAR ENERGY

51210 (CONF-771253—, pp 146-176) **Research and development program for solar energy.** Solo, R.A. (Michigan State Univ., East Lansing). Jun 1978.

From Symposium on competition in the solar energy industry; Washington, DC, USA (15 Dec 1977).

The paper analyzes and critiques what are considered to be the realities and essentials of the DOE's R and D program as a framework for significant policy proposals. It is a program that operates with certain inherent constraints. The current Federal solar program falls into two categories. First there is the effort to develop prototype systems and items of hardware, specifically modern windmills, lower cost versions of the photovoltaic cells used in the space program to convert light into electric power, an ocean thermal unit that would use the hot/cold relationship of deep and surface ocean waters as an energy source, solar heat collectors and concentrators for power production and as part of larger energy-utilizing complexes, and systems to harvest agricultural residues and water-grown equivalents. The second category of solar programs integrates directly into the competitive interaction of the market economy. Here the strategy is grantsmanship: inviting proposals and passing out money to selected proposers, institutes, professors, corporations, or builders, as the case may be. The supposition here is that projects so supported will produce information or demonstrate technologies that will in turn provide inspiration and guidelines to others. This category includes residential and commercial solar heating and lighting, use of solar heat and power in agricultural processes, a portion of the aforementioned biomass program, and conservation. The scattter-grant approach is familiar; it has been used repeatedly and, the author contends,has never succeeded in producing innovation and technological advance of any significance.

51211 (LBL—9214) **Measurement and analysis of circumsolar radiation.** Grether, D.F.; Evans, D.; Hunt, A.; Wahlig, M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1979. Contract W-7405-ENG-48. 9p. P 02/MF A01.

This project uses specially developed instruments to measure the solar and circumsolar radiation for application to solar energy systems that employ concentrating collectors. The instruments, which consist of scanning collectors. The instruments, which consist of scanning telescopes mounted on a precision solar tracker, and their locations are described. The data processing capabilities, which aid in the analysis of the performance of each instrument system, are

discussed. Data supplied by LBL to others are also mentioned. Recent colored filter data are shown and a comparison of circumsolar radiation data obtained at Atlanta and Barstow is given.

51212 Solar Energy Research Institute's plans and programs to encourage the application of solar energy. Yokell, M.D. pp 480-486 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

SERI is a national research institute, owned by the Federal government. In order to discuss what SERI's mission is and how it will be accomplished, the following areas are discussed: research, analysis and assessment, program evaluation, program management, program development, commercialization, information dissemination, university research, education and training, conferences and workshops, international programs, state and local programs, and interfaces and liaison. The public infomation office, library, data base, referral service, relations to services provided by other organizations, publications and public forums are discussed in order to describe how SERI can help and cooperate with industry in the commercialization of solar energy.

51213 Energy from the sun. Chicago, IL; Institute of Gas Technology (1978). 504p. (CONF-780462—). $40.00.

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

Separate abstracts were prepared for each paper. (MHR)

RESOURCES AND AVAILABILITY

51214 (HCP/T4016—01/2) **Solar-climatic statistical study.** Bray, R.E. (Northrop Services, Inc., Huntsville, AL (USA)). Feb 1979. Contract EG-77-C-01-4016. 570p. Dep. NTIS, PC E10/MF E10.

The Solar-Climatic Statistical Study was performed to provide statistical information on the expected future availability of solar and wind power at various nationwide sites. Historic data (SOLMET), at 26 National Weather Service stations reporting hourly solar insolation and collateral meteorological information, were interrogated to provide an estimate of future trends. Solar data are global radiation incident on a horizontal surface, and wind data represent wind power normal to the air flow. Selected insolation and wind power conditions were investigated for their occurrence and persistence, for defined periods of time, on a monthly basis. Information of this nature are intended as an aid to preliminary planning activities for the design and operation of solar and wind energy utilization and conversion systems. Presented in this volume are probability estimates of solar insolation and wind power, alone and in combination, occurring and persisting at or above specified thresholds, for up to one week, for each of the 26 SOLMET stations. Diurnal variations of wind power were also considered. Selected probability data for each station are presented graphically, and comprehensive plots for all stations are provided on a set of microfiche included in a folder in the back of this volume.

ECONOMICS

REFER ALSO TO CITATION(S) 51230, 51232, 51283

ENVIRONMENTAL, LEGAL, AND INSTITUTIONAL ASPECTS

REFER ALSO TO CITATION(S) 51298

51215 (CONF-771253—) **Solar market: proceedings of the symposium on competition in the solar energy industry.** (Federal Trade Commission, Washington, DC (USA). Bureau of Competition). Jun 1978. 310p. I .

From Symposium on competition in the solar energy industry; Washington, DC, USA (15 Dec 1977).

Separate abstracts are presented for 11 papers (Parts I, II, and III) presented at the Solar Energy Symposium. An additional abstract is prepared for Part IV which is composed of remarks by a panel of governmental representatives describing the solar programs and activities of their respective agencies. A contribution by Dr. Barry Commoner, The Solar Transition, is included in an appendix. (MCW)

51216 (CONF-771253—, pp 11-58) **Standards for the solar industry.** Butt, S.H. (Solar Energy Industries Association, Washington, DC). Jun 1978.

From Symposium on competition in the solar energy industry; Washington, DC, USA (15 Dec 1977).

Solar heating and cooling industry standards that are needed are not yet fully developed. However, there are existing standards that do fulfill many of the needs of the user and of the industry and activity is underway to improve and add to existing systems of standards. HUD solar standards are discussed. Installation standards; building codes; standard code writing; performance testing procedures; and a proposal by the Solar Energy Research and Education Foundation of a solar collector rating, labeling, and certification program initiated by government and industry are discussed. Finally, the standards development process is presented. Additional information is included in an Attachment, Recommendations for Standards Development and Implementation.

51217 (CONF-771253—, pp 59-79) **Antitrust issues in setting and enforcing product standards.** Hoffman, J.E. (Wald, Harkrader and Ross, Washington, DC). Jun 1978.

From Symposium on competition in the solar energy industry; Washington, DC, USA (15 Dec 1977).

There exists a need for information, a need for assistance in the easy and effective use of products of a new technology, and a need for safety when complex products are marketed in new, technology-based industries. The consumer's traditional recourse in meeting these needs has been government. An alternate source of aid to the consumer is the privately developed product standard and certification program, backed perhaps by government sanction. The potential competitive costs and benefits inherent in any set of standards are first reviewed. Applicable antitrust principles are discussed, particularly citing Section 1 of the Sherman Act. The author uses the Federal Trade Commission's opinion letter to the American National Standards Institute concerning the general format of ANSI's proposed voluntary certification program for manufacturers of consumer goods to discuss standards and antitrust. The letter lists 16 factors that should be considered in any antitrust evaluation of a program of self-regulation. And the opinion letter is also used to discuss the substance of standards and assuring compliance with standards. It is concluded that antitrust is unwilling to give either a sweeping endorsement or a sweeping condemnation to the formulation, substance, or enforcement of industry standards. (MCW)

51218 (CONF-771253—, pp 80-106) **Overview: the development of solar standards and its effect on consumers.** Lawrence, S. (Consumer Action Now, Washington, DC). Jun 1978.

From Symposium on competition in the solar energy industry; Washington, DC, USA (15 Dec 1977).

There is a need for some common language with which to compare the performance of solar systems, specifically those used for heating and hot water, and which is understandable to consumers, architects, and builders. Several initiatives in government and industry are moving in this direction. The American National Standards Institute is coordinating the private industry voluntary consensus standards process and governmental initiatives have taken place at both the Federal and state levels. Activities of participating agencies are discussed. The development of standardization in the solar industry is against a backdrop of growing debate over the entire voluntary standards system and the proper roles of both industry and government in setting standards. The use of industry-generated standards by local, state, and Federal authorities as the basis for safety codes and for procurement decisions is one part of the problem, for frequently this is done without proper examination of the process by which the standard has been derived. The other half of the problem is rooted in the makeup and procedures of the standards-setting committees themselves. The building code interface and testing, licensing, and warranty requirements are discussed. Government programs, directions, and goals are briefly discussed.

51219 (CONF-771253—, pp 107-118) **Petroleum companies and solar energy: a real issue.** Kauper, T.E. (Univ. of Michigan, Ann Arbor). Jun 1978.

From Symposium on competition in the solar energy industry; Washington, DC, USA (15 Dec 1977).

A generalized discussion of the role of the petroleum industry in the research, development, production, and marketing of solar energy and related hardware is presented. Data concerning market structure and performance have traditionally been the key elements of any competitive analysis. Because this data is lacking in this new industry so far as the developing solar energy industry is concerned, this general framework of principle is devised; however, certain facts are known. It is appropriate in the short run to examine the petroleum industry's role in the context of research and development with respect to solar energy and related hardware. Restraints on petroleum company involvement in the solar energy industry and governmental protection and promotion of competition are discussed. (MCW)

51220 (CONF-771253—, pp 119-135) **Promoting competition in tomorrow's markets for solar energy systems.** Schmalensee, R.L. (Massachusetts Inst. of Tech., Cambridge). Jun 1978.

From Symposium on competition in the solar energy industry; Washington, DC, USA (15 Dec 1977).

Policies concerned with competition in the solar energy markets of the future are special. Federal intervention in energy seeks to cause decisions to be based on social rather than private demands and costs. The national energy policy at least in part perceives that private demands and costs, as revealed by behavior in energy markets, do not properly indicate social valuations. Since the total real cost to the nation of using imported oil exceeds its market price, market demand overstates the real social demand for imported oil. Similarly, the social demand for systems that permit exploitation of solar energy has been found to exceed the market demand. In the solar context, this combination of a socially inadequate private demand and the importance of technical change not only renders concern with competition more important than it otherwise would be but also complicates the translation of that concern into particlar policies. The paper explores these basic difficulties, then, four sections deal with aspects of public policy with potential effects on market competition: antitrust, government procurement, patents, and policy toward privately-funded research and development. The analysis and its implications are summarized in a final section which concludes that while it is potentially very important to consider the effects of current actions on future competitive conditions, there are no simple ways of doing this that have great promise. The paper is primarily concerned with providing a framework for considering the relevant issues and tradeoffs, not with proposing the details of policy. (MCW)

51221 (CONF-771253—, pp 136-145) **Competition factor in the solar research and development program.** Kestenbaum, L. (Bergson, Borkland, Margolis and Adler, Washington, DC). Jun 1978.

From Symposium on competition in the solar energy industry; Washington, DC, USA (15 Dec 1977).

Government has the opportunity to shape the course of events in an industry not yet in place; and this is likely to be true of solar energy. As solar energy is developed, the solar field should attract a diversity of entrants, who will come from varied relevant technologies, and those not connected with existing energy technologies. The fact that the Federal government is actively involved in promoting research and development in the incipient industry provides a further opportunity, and a responsibility, to affect the array of firms and the range of technological choices in the new field. In connection with this government role, two questions are considered. Is a concern for competition appropriate and is it consistent with, or at odds with, or irrelevant to, the mission of solar energy research and development? To what extent can the government research and development program influence the course of a future industry's structure and competitive performance? After this discussion, the prospect of entry by oil companies or other existing major energy firms is examined. The review does not suggest any natural gravitational pull between the administration of government research and development programs and existing energy companies. It has been suggested, though, to limit the entry or expansion of established firms into new technologies or fields. Such policies are sought to be justified by the desire to foster the independent development of the new technologies. They are also based on the assumption that the major firms in existing industries have interests that conflict with new competitive technology, and have market power that might well be used to suppress or hinder it. (MCW)

51222 (CONF-771253—, pp 179-197) **Maintaining competition in solar energy technology.** Noll, R.G. (California Inst. of Tech., Pasadena). Jun 1978.

From Symposium on competition in the solar energy industry; Washington, DC, USA (15 Dec 1977).

The debate about the likely speed and extent of commercialization of solar energy technology usually focuses on technical and economic issues, but the future of solar energy development may depend on the issue: will public utilities and their regulators, by intent or inadvertence, block or retard the adoption of cost-effective solar technologies? This paper explores the latter issue, assuming that solar energy is or will soon be an economically viable source of energy. It also explores what, if any, institutional barriers to the adoption of solar energy are likely to emerge. Solar energy presents 3 major problems to utilities and their regulators. First, distributed solar technologies are not consistent with the natural monopoly rationale for public utilities, and thereby threaten to undermine the utility industries. Solar is rarely an economical total substitute for conventional energy, and because of its dependence on weather conditions, may have little or no effect on peak demand and, therefore, on the capacity requirements of conventional utilities. Third, for the most part the existing methods of pricing gas and electricity provide the wrong incentives to utilities, utility customers, and commercial solar energy firms. The ways in which the present structure of the utility sector is affected by and will affect the development of commercial solar energy systems and the likely consequences of alternative structures are examined. (MCW)

51223 (CONF-771253—, pp 198-213) **Participation of electric utility companies in the solar energy industry.** Kitt, H.P.; Frazier, C.H.; Stelzer, I.M. Jun 1978.

From Symposium on competition in the solar energy industry; Washington, DC, USA (15 Dec 1977).

The determination of an appropriate role for electric utility companies in the solar energy industry involves a possible conflict between energy and antitrust policies. The former seek a maximum economic rate of development and role for solar, to supplement nonrenewable resources; the latter look to the preservation of the competitive process, even if that would deny to the new solar industry the resources of the other energy industries. The interaction of the electric utilities and the solar energy industry occurs on two levels. First, the utilities can be viewed as consumers of solar technology: they can employ it to generate electricity. Second, they can be viewed as competitors of suppliers of solar-produced energy. The use of solar energy for power generation is discussed, but the various levels of potential competitive interaction between the utilities and the purveyors of solar energy other than central station thermal power generation are emphasized. (MCW)

51224 (CONF-771253—, pp 214-228) **Solar energy, public utilities, and the competitive economy.** Zillman, D.N. (Arizona State Univ., Tempe). Jun 1978.

From Symposium on competition in the solar energy industry; Washington, DC, USA (15 Dec 1977).

Solar energy passed through three phases: in the late 1960s and early 1970s, solar energy's image was composed in part of solar cells in outer space; following the 1973 oil embargo, solar development became a serious national concern; and now solar is consolidating its early gains and being acclaimed as an alternate energy source. An inquiry into the relationship of solar energy, small business, and the utilities within our competitive economy must include a number of legal considerations. Progress in the solar industry and a review of the major antitrust statutes and the relationships between the antitrust laws and the regulated utilities are examined. Emphasis is on the Sherman Act. Solar development will depend on choices made by consumers, large and small producers, the housing industry, and financial community, electric utilities, and government, and these choices will not be made entirely by the free market. It is concluded that government will have a large role in the further direction of utility and business interest in solar. (MCW)

51225 (CONF-771253—, pp 229-252) **Electric utilities and solar energy: competition, subsidies, ownership, and prices.** Habicht, E.R. Jun 1978.

From Symposium on competition in the solar energy industry; Washington, DC, USA (15 Dec 1977).

This discussion of solar energy is limited to its integration with electric utilities. Though electricity is nearly everywhere costly in comparison with alternative fuels, solar energy systems may first be deployed with electrical backup since this has lower installation costs than oil- or gas-fueled systems. Also, gas and oil may become scarce and costly relative to electricity, the cost of which may not escalate as rapidly. This paper focuses on active systems, none of which has been properly placed in perspective with electric utilities, with the exception of a few space heating and cooling systems. It is the intent of the paper to direct concern away from the question of ownership of solar energy devices and toward the central issue of entry of a new array of technologies for generating, saving, or substitutitng for electricity. Current energy policy, several peculiarities of electric utilities, the significance of prices, and some logical points of entry for the nascent solar industry are described. Briefly, ownership, with some suggestions for enhancing economic outcomes while abating emotionalism and minimizing litigation, is discussed. (MCW)

51226 (CONF-771253—, pp 255-279) **Government involvement in solar energy.** Jun 1978.

From Symposium on competition in the solar energy industry; Washington, DC, USA (15 Dec 1977).

Part IV of the symposium is a collection of remarks on solar programs by a panel of government representatives, namely: Ronald D. Scott, DOE; Lloyd O. Herwig, DOE; Joseph Sherman, HUD; Robert D. Dikkers, NBS; Raymond D. Marchakitus, Small Business Administration; Anthony Robinson, Small Business Administration; and Henry Kelly, OTA, US Congress. (MCW)

51227 (SERI/TP—53-114R) **Review of the environmental effects and benefits of selected solar energy technologies.** Lawrence, K.A. (Solar Energy Research Inst., Golden, CO (USA)). May 1979. Contract EG-77-C-01-4042. 18p. P 02/MF A01.

Data are reviewed and summarized on the environmental effects of three solar energy technologies: photovoltaic cells, wind energy conversion (WEC), and the solar thermal central receiver. Potential effects are identified for each of the life cycle phases: resource extraction and component manufacture, plant construction, operation and decommission. The solar energy technologies are assumed to be deployed as centralized energy production facilities. The technologies examined are materials intensive compared to fossil fuel plants with the same power rating. As a result, the life-cycle phase of resource extraction and component production is the most environmentally hazardous. Impacts of plant construction will be somewhat site specific but should approximate impacts associated with any large construction activity. The operation phase is relatively environmentally benign. WEC operation does produce low-level noise pollution and presents minimal hazards to flying species. Solar thermal facilities equipped with wet cooling towers may affect local air quality via cooling tower drift. In addition, large installations of each option may alter local microclimate. Decommission of WEC, solar thermal, and Si-photovoltaic facilities should present no environmental hazards, although disposal of CdS or GaAs cells will require care.

51228 **State approaches to solar legislation: a survey.** Johnson, S.B. *Sol. Law Rep.;* **1**: No. 1, 55-137(May 1979).

As recently as 1975, few states had enacted significant solar legislation. Since that time, the pace of consideration and passage of state statutes designed to encourage the application of solar technology has accelerated. A complex and significant body of state law has evolved. This article is a comprehensive survey of that body of state statutes through early 1979. Most such legislation falls into several broad categories. A large majority of the states have enacted financial incentives designed to stimulate solar energy use. Commonly, these incentives include special property tax treatment of solar systems, and income tax benefits to solar users. There are a wide variety of other tax provisions as well. Some states have loan or grant programs for solar installation. States have also attacked the problems of real estate law and land-use planning, which have often been seen as barriers to the use of solar technology, e.g., solar access and restrictive covenants and zoning. In addition to removing obstacles to solar energy use, the legislation of several states provides affirmative recognition of the potential of real property law to serve as a spur to solar development. The growing group of statutes governing building codes and performance, testing, and materials standards is also assessed. A number of states have legislated in the utility regulation field, attempting to affectthe important questions of the price for utility backup to solar systems, nondiscrimination, and cogeneration. Appendices give information on how to locate state solar statutes, and on state legislation promoting a variety of solar activities. 2 figures, 4 tables.

51229 **Solar energy legislation in the 95th Congress.** Dawkins, L.; Troutman, G. Contract EG-77-C-01-4024. *Sol. Law Rep.;* **1**: No. 1, 139-155(May 1979).

The 95th Congress is notable for a large body of solar legislation, whose highlights are: loans and tax credits for residential and commercial solar installations; grants to schools and hospitals for solar installations; installation of solar heating and cooling systems in Federal buildings; $98 million for Federal procurement of photovoltaic equipment; $470.2 million in appropriations to DOE for solar in FY79; solar demonstrations in military, agricultural, and foreign-service applications; establishment of the Energy Extension Service; and energy assistance to developing countries. Most of the legislators who demonstrated strong support for solar energy in the 95th Congress were returned for the 96th, and the Solar Coalition can be expected to renew its vigorous efforts to promote solar legislation. Major issues that will probably receive increased attention in this Congress include low-interest loans through a Solar Energy Development Bank, consumer protection, the maintenance of competition within the industry, and the elimination of institutional barriers to solar commercialization. If congressional interest continues to develop as rapidly as it did in the 95th, solar energy's potential contribution to national energy needs may be greatly enhanced. 2 tables.

51230 **Guidelines and criteria for the California solar energy tax credit.** Sacramento, CA; California Energy Commission (1978). 17p. (NP—23836).

Discussions are included on the following: general provisions, definitions, active systems, passive systems, eligible energy conservation measures, swimming pool and hot tub applications, other applications, and claims of exemption. (MHR)

51231 **Role of the gas industry in solar energy, 1978.** Menzer, M. (American Gas Association, Arlington, VA). pp 1-7 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

More of our natural gas needs are being satisfied by gas from deeper, more expensive wells and supplemental sources. Solar energy is an energy source that is compatible with gas in many applications. While not being competitive with gas from the consumers viewpoint, solar may soon be attractive to the gas utility when the alternative is the higher-price gas supplements. Utilities and utility regulatory agencies are presently involved with evaluating the proper role for the energy utility with respect to solar. Possible types of involvement are: research, development, and demonstration; public information; financing; leasing and sales; and direct ownership. The gas industry is already involved in R, D, and D and public information activities. More active involvement is contingent upon the resolution of many legal and regulatory entanglements. These activities can provide long-term stability to the energy utilities, minimize the rise of customer's fuel bills, and help accelerate the acceptance of solar energy.

51232 **Commercial and industrial solar energy: economic barriers and incentives.** Butt, S.H. (Olin Corp., East Alton, IL). pp 371-377 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

To date, principal activity in solar has been in residential applications. Industrial uses for solar energy have been somewhat neglected. Little emphasis has been placed upon them by the Department of Energy. The commercial industry has also chosen to emphasize residential applications--particularly domestic hot water. Nonresidential applications tend to be relatively diverse in their requirements. Systems have to be designed for each individual application. Reasons for lack of activity in commercial and industrial uses of solar energy are explored, and methods for accelerating solar use are recommended.

SOLAR ENERGY CONVERSION

REFER ALSO TO CITATION(S) 51833

PHOTOVOLTAIC CONVERSION

REFER ALSO TO CITATION(S) 51203, 51227, 51318, 51900

51233 (DOE/JPL—1012-78/2) **Photovoltaic solar panel resistance to simulated hail. Low-Cost Solar Array Project.** Moore, D.; Wilson, A. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Oct 1978. Contract EX-76-A-29-1012. 34p. P 03/MF A01.

As part of the Jet Propulsion Laboratory's Low-Cost Solar Array Project, test methods have been evaluated and procedures developed for testing photovoltaic flat-plate solar cell modules for resistance to impact by hailstones. Testing has included the use of simulated hailstones (frozen ice spheres projected at terminal velocity), steel balls, and other projectile types applied with three loading methods: pneumatic gun, gravity drop, and static loading. Results are presented that compare the advantages and disadvantages of the three test methods. Dropped-steel-ball tests are shown to exhibit little correlation with high-velocity ice-ball tests, whereas statically-loaded steel balls show a somewhat better correlation with ice-ball tests. Results are also presented on the hail impact strength of 16 flat-plate photovoltaic modules. The module designs tested have been shown to be capable of withstanding as large as 1-1/2-inch diameter and not capable of withstanding as small as 1/2-inch diameter simulated hail. The top surface material of the modules has a dominant influence on the hail impact resistance of the modules. In order of increasing impact strength for a given thickness, the top surface materials encountered in the modules tester were: clear silicone rubber, annealed glass, tempered glass, and acrylic sheet. The critical failure mechanism of each module type is explored and means for improving the hail resistance of future modules are described.

51234 (DOE/JPL/954343—13) **Process feasibility study in support of silicon material task 1. Quarterly technical progress report (XIII), September—December 1978.** Li, K.Y.; Hansen, K.C.; Yaws, C.L. (Lamar Univ., Beaumont, TX (USA). Dept. of Chemical Engineering). Dec 1978. Contract NAS-7-100-954343. 69p. P 04/MF A01.

Major activities during this reporting period centered on process system properties, chemical engineering and economic analyses. Analyses of process system properties was continued for materials involved in the alternate processes under consideration for solar cell grade silicon. The following property data are reported for trichlorosilane: critical constants, vapor pressure, heat of vaporization, gas heat capacity, liquid heat capacity, density, surface tension, viscosity, thermal conductivity, heat of formation of Gibb's free

energy of formation. Major efforts were expended on completion of the preliminary economic analysis of the UCC Silane Process (Union Carbide Corporation Silane Process). Cost, sensitivity and profitability analysis results are presented based on a preliminary process design of a plant to produce 1,000 metric tons/year of silicon by the revised process. Fixed capital investment estimate for the plant is $9.19 million (1975 dollars). Product cost without profit is 6.90 $/kg of silicon (1975 dollars). The profitability results indicate a sales price of 9.88 $/kg of silicon (1975 dollars) at a 20% DCF return on investment after taxes. Major chemical engineering activities were started on the modified BCL process which includes additional data and engineering modification. The preliminary process design was initiated including specific base case conditions, reaction chemistry, process flow diagram and material balance for a plant to produce 1,000 Mt/yr of solar cell grade silicon.

51235 (DOE/JPL/954521—7) **Integral glass encapsulation for solar arrays. Quarterly progress report No. 8.** (Spire Corp., Bedford, MA (USA)). Oct 1978. Contract NAS-7-100-954521. 29p. P 03/MF A01.

This is the eighth quarterly report under a program to develop integral glass encapsulation of terrestrial solar arrays through electrostatic bonding. The goal of this program is to develop bonding techniques and module designs demonstrating a low-cost encapsulation system that will provide protection of solar arrays for periods of 20 years or more. Electrostatic bonding is a technique for encapsulating solar cells of silicon and other materials in glass. No adhesives or secondary encapsulants are required. Bonding is a rapid process accomplished in only a few minutes and ideally suited for automated, in-line processing. Economic analyses have shown that this method of encapsulation is cost-effective, and will meet the 1986 LSA price goals. Several module designs incorporating electrostatic bonding have been demonstrated. Two fundamental configurations have been defined and proven. Common to both is an integral glass front superstrate assembly. This part may be coated with any of several conventional backings to provide a very low cost system. For ultimate protection and extended array lifetime, a back glass may be hermetically sealed to the front by electrostatic bonding. Accelerated environmental testing of both of these systems has proven their reliability. Status of the program is reported.

51236 (DOE/JPL/954589—7) **Low Cost Solar Array Project, Silicon Materials Task. Development of a process for high capacity arc heater production of silicon for solar arrays. Quarterly technical report, July—September 1978.** (Westinghouse Electric Corp., Trafford, PA (USA). Power Circuit Breaker Div.). 1978. Contract NAS-7-100-954589. 97p. P 05/MF A01.

A program has been established at Westinghouse to develop a high temperature silicon production process using existing electric arc heater technology. Silicon tetrachloride and a reductant (sodium) will be injected into an arc heated mixture of hydrogen and argon. Under these high temperature conditions, a very rapid reaction is expected to occur and proceed essentially to completion, yielding silicon and gaseous sodium chloride. Techniques for high temperature separation and collection of the molten silicon will be developed using standards engineering approaches, and the salt vapor will later by electrolytically separated into its elemental constituents for recycle. Preliminary technical evaluations and economic projections indicate not only that this process appears to be feasible, but that it also has the advantages of rapid, high capacity production of good quality molten silicon at a nominal cost. The status of the program is described.

51237 (DOE/JPL/954614—1) **Lifetime and diffusion length measurements on silicon material and solar cells.** Othmer, S.; Chen, S.C. (Northrop Research and Technology Center, Palos Verdes Peninsula, CA (USA)). 1977. Contract NAS-7-100-954614. 99p. P 05/MF A01.

Experimental methods were evaluated for the determination of lifetime and diffusion length in silicon intentionally doped with potentially lifetime-degrading impurities found in metallurgical grade silicon, impurities which may be residual in low-cost silicon intended for use in terrestrial flat-plat arrays. Results obtained by these methods were compared for mutual consistency. Lifetime measurements were made using a steady-state photoconductivity method, which was compared with a photoconductivity decay technique. Diffusion length determinations were made using short-circuit current measurements under penetrating illumination. This method was compared with a direct measurement of diffusion length using a scanning electron microscope. Mutual consistency among all experimental methods was verified, but steady-state photoconductivity was found preferable to photoconductivity decay at short lifetimes and in the presence of traps. The effects of a number of impurities on lifetime in bulk material, and on diffusion length in cells fabricated from this material, were determined. Results were compared with those obtained by others on the same material and devices using different techniques. General agreement was found in terms of the hierarchy of impurities which degrade the lifetime.

51238 (DOE/JPL/954654—5) **Silicon web process development: Low Cost Solar Array Project, Large Area Silicon Sheet Task. Quarterly report, July 1—September 30, 1978.** Duncan, C.S.; Seidensticker, R.G.; Hopkins, R.H.; McHugh, J.P.; Wehrli, H.A.; Heimlich, M.E.; Driggers, J.M. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 1978. Contract NAS-7-100-954654. 60p. P 04/MF A01.

A manually operated system for continuous melt replenishment was completed and installed in the RE web growth facility. Initial results are positive though incomplete. Polysilicon pellets were fed for comparatively short periods, to 14 minutes, while web was growing without any disturbance from the pellet feed. A bench model of a manually-controlled mechanial pellet feeder was developed for later inclusion in the melt replenishment system. An afterheater with adjustable temperature and adjustable temperature gradient was installed in the J web growth facility for the purpose of controlling the vertical temperature gradient and the thermal stress generated in the growing web. The initial operation disclosed that the range of temperatures was somewhat less than intended and minor modifications have been made but not yet evaluated. The W web growth facility has performed well with respect to width control. Two problems have persisted and are undergoing developmental improvement: excessive deposits of oxide on the web, lid and heat shields and, secondly, objectionably high stress in the web. Computer models of temperature profile and stress are being used to support the development of lower stress in web grown from the W facility and the J facility which includes the afterheater system for vertical temerature gradient control. In addition, actual stress measurements in web grown are routinely made in order to evaluate results.

51239 (DOE/JPL/954777—5) **Silicon halide—alkali metal flames as a source of solar grade silicon.** Olson, D.B.; Miller, W.J. (Aerochem Research Labs., Inc., Princeton, NJ (USA)). Oct 1978. Contract NAS-7-100-954777. 15p. (AeroChem-TN—199). P 02/MF A01.

This program is designed to demonstrate the feasibility of using alkali metal-silicon halide diffusion flames to produce solar-cell-grade silicon in large quantities at low cost. Prior work has demonstrated that high purity silicon (metallic impurities < 5 ppm) can be produced using Na + $SiCl_4$ and Na + SiF_4 flames. Much lower flame temperatres were observed in the latter case as well as low silicon yields due to Na_2SiF_6 formation. Work performed during the current reporting period has shown that reactor wall temperaure of approximately 1000 K are sufficient to prevent formation of Na_2SiF_6. Silicon produced from SiF_4 appears identical in form and purity to that from $SiCl_4$ although product collection and separation are less thermo-chemically favored in the fluoride system. To separate the silicon from the byproduct salt in an efficient and continuous manner, higher temeratures are necessary. Resistively heated thin-walled graphite tubular reactors have been used to achieve these temperatures (> 1700 K), and successful product separation has been experimentally demonstrated using a Na + $SiCl_4$ flame. Keys to this success appear to be sustaining high reaction temperatures and not using a diluent gas in the recent flows.

51240 (DOE/JPL/954868—3) **Automated array Assembly, Phase II. Quarterly report No. 3, April 1—June 30, 1978.** D'Aiello, R.V. (Alabama A and M Univ., Normal (USA)). Jun 1978. Contract NAS-7-100-954868. 44p. P 03/MF A01.

The purpose of the overall program is to establish technological readiness and provide verification for the elements of a manufacturing sequence which would ultimately be suitable for the large-scale production of silicon solar-array modules at a selling price of less than $500/kW. A program and process plan for accomplishing this objective was developed and put into operation. This plan is centered around a processing sequence using Czochralski, silicon wafers. Three junction-formation processes are considered since cost analyses show that they do not differ greatly in cost. The progress made in the various process steps of the plan is described, and plans for the next quarter are summarized.

51241 (DOE/JPL/954876—4) **Development and evalustion of die and container materials. Fourth quarterly progress report, July 1—September 30, 1978.** Wills, R.R.; Niesz, D.E. (Battelle Columbus Labs., OH (USA)). 15 Oct 1978. Contract NAS-7-100-954876. 24p. P 02/MF A01.

Mass spectrometric studies of molten silicon in contact with mullite and $x = 0.75$ β' Sialon show that the vapor pressures of Si, SiO, Al, and Al_2O species are very similar. In both cases the oxygen solubility is extremely low, but the aluminium content of the silicon is higher for the mullite—silicon system (3 weight percent), compared with 5000 ppm for the $x = 0.75$ β' Sialon. The nitrogen concentration (312 ppm) of the silicon is marginally below that for the Si_3N_4—silicon system indicating that the addition of aluminium and oxygen to β Si_3N_4 does stabilize the nitrogen to some extent. Silicon beryllium oxynitrides were fabricated by hot pressing Si_3N_4—BeO-SiO_2 mixtures using three Si_3N_4 powders. Single phase materials were obtained with KBI, Inc. and Sylvania SN502 grade

powders, but not with Sylvania SN402 grade powder. Preliminary evaluation of the silicon beryllium oxynitride materials with molten silicon did not reveal any attack of these materials. X = 0.75 β' Sialon did, however, undergo slight attack. It is suggested that the rate of dissolution of aluminium in molten silicon could be affected by whether the Sialon is used in an inert atmosphere or under vacuum conditions.

51242 (DOE/JPL/954901—4) **Development and evaluation of die materials for use in the growth of silicon ribbons by the inverted ribbon growth process. Task II: LSSA project. Quarterly report No. 4.** Duffy, M.T.; Berkman, S.; Moss, H.I.; Cullen, G.W. (RCA Labs., Princeton, NJ (USA)). Sep 1978. Contract NAS-7-100-954901. 17p. P 02/MF A01.

The results of emission spectroscopic analysis indicate that molten silicon (sessile drop) can remain in contact with hot-pressed Si_3N_4 (99.2% theoretical density) for prolonged periods without attaining the impurity content level of the nitride. It is interesting to note that, although MgO was used as binder (~ 3.8%), Mg was not found present in the silicon sessile drop in quantities much above the level initially present in the silicon source material. The conversion of CVD silicon oxynitride to β-Si_3N_4 can be carried out at high temperature in N_2 (~ 1600°C), by contact with molten silicon or by a combination of these steps. Conversion in the presence of molten silicon appears preferable. Preliminary experiments with EFG-type dies coated with CVD Si_3N_4 or CVD SiO/sub x/N/sub y/ indicate that capillary rise does not occur readily in these dies. The same was found to be true of hot-pressed and reaction-sintered Si_3N_4 obtained commercially. However, when dies were formed by depositing CVD layers on shaped silicon slabs, a column of molten silicon (~ 2.5 cm high) was maintained in each CVD die while being heated (~ 30 min) in contact with a crucible of molten silicon. Preliminary wetting of dies appears necessary for EFG growth. Several ribbon growth experiments were performed in our new ribbon growth facility from V-shaped dies. Both CVD Si_3N_4 and CVD SiO/sub x/N/sub y/ coatings were used on the die parts. There is also a problem with the wetting of SiO/sub x/N/sub y/ in the inverted ribbon growth process but not with Si_3N_4 layers. After about 90 min in contact with the melt, however, silicon flows into the defining slot in the case of SiO/sub x/N/sub y/ coatings.

51243 (DOE/JPL/954914—4) **High velocity continuous-flow reactor for the production of solar grade silicon. Fourth quarterly report, June 25—September 24, 1978.** Woerner, L. (Schumacher (J.C.) Co., Oceanside, CA (USA)). Sep 1978. Contract NAS-7-100-954914. 35p. P 03/MF A01.

The main effort has been concentrated on investigating the pyrolysis of tribromosilane in a fluid bed reactor. Excellent results have been achieved in this area with the yields running in excess of 90% of the theoretical possible for the reaction given below: $4SiHBr_3 = 2H_2 + 3SiBr_4 + Si$. An average growth rate of 0.5 microns per minute, based on starting and ending sieve analysis data for the bed, has been noted. This coating on the particles is a very fine nodular coherent coating. Since the reaction cited generates 3 moles of $SiBr_4$ for each mole of Si, an investigation was begun to determine if $SiBr_4$ could be converted to $SiHBr_3$ by reaction with a heated bed of silicon and hydrogen. Preliminary experiments have shown that this is readily feasible. This factor allows the description of closed loop process in which only silicon is consumed and produced. The cycle is given below. Decomposition: $SiHBr_3 = Si + 2H_2 + 3SiBr_4$. Conversion: $2H_2 + SiBr_4 + Si/sub\ (met)/ = SiHBr_3$.

51244 (DOE/JPL/954929—3) **Investigation of reliability attributes and accelerated stress factors on terrestrial solar cells. Third quarter report, June 9—September 9, 1978.** Lathrop, J.W.; Prince, J.L. (Clemson Univ., SC (USA)). 15 Oct 1978. Contract NAS-7-100-954929. 43p. P 03/MF A01.

Results of the third quarter of work on the program Investigation of Reliability Attributes and Accelerated Stress Factors of Terrestrial Solar Cells include completing all Phase I tests except for Thermal Shock. Results of these preliminary tests are used to define the larger quantity Phase II tests and a number of these were begun during the quarter. A program was initiated to observe the effects of accelerated testing on cell metalization adherence. Degradation of electrical performance was observed on one type of cell after B-T testing. Mechanical fracturing was observed in two types of cells after thermal cycling.

51245 (DOE/TIC—10451) **DOD photovoltaic energy conversions systems: market inventory and analysis. Volume I.** (Federal Energy Administration, Washington, DC (USA)). Jun 1977. 212p. P 10/MF A01.

This report provides realistic estimates of the potential DOD market for photovoltaics for a range of scenarios examined. An assessment has been made of potential actions which the DOD can take to accelerate industry and market development of photovoltaics. The principal focus of the study is on delineating near term DOD markets. Analyses indicate that a large DOD and private sector market for photovoltaic energy systems should develop as unit array costs decline from the current price of $15.50 per peak watt (Wp) to $2/Wp or less. Such a decline would be expected to occur if mass production techniques replaced the current handcrafted production processes. These markets could sustain rapid industry development into the early 1980's. At this point, major new intermediate term markets must be developed to support continued industry growth. Eventually prices may decline to the point where photovoltaic energy systems are cost effective relative to commercial electric power. The advantages to DOD offered by photovoltaics are discussed. In addition to potential cost and fuel savings, photovoltaic energy systems would provide the DOD a highly reliable, silent power source allowing virtually unattended operation in most areas of the world. Near term benefits to the DOD include cost and logistics savings at remote sites, in portable equipment and offshore applications. The national benefits from accelerated commercialization of photovoltaics are considered. Over the longer term, photovoltaic energy systems will offer the nation a cost competitive source of commercial electric power or provide a user-owned dispersed source of power, thus reducing dependence on foreign energy sources. Other national benefits include the development of exports to underdeveloped countries where photovoltaic systems could be utilized for rural electrification and irrigation pumping.

51246 (DSE—3413-T1) **Photovoltaic mechanisms in polycrystalline thin film solar cells. Quarterly technical progress report No. 2, January 1, 1979—March 31, 1979.** Storti, G.; Johnson, S.; Lin, H.C.; Armstrong, R.W. (Solarex Corp., Rockville, MD (USA)). 1979. Contract ET-78-C-01-3413. 24p. P 02/MF A01.

The effect of grain size on short circuit current density was investigated by approximating individual silicon grains as right circular cylinders and solving the diffusion equation within the base region. This model confirms the previous results that for grain radii exceeding a few tenths of a millimeter, the minority carrier lifetime in the grain essentially determines the short-circuit current response of the cell. The dark I-V characteristics of some polycrystalline solar cells were measured and compared with single crystal cells. The dark current of the polycrystalline cells is dominated by recombination within the space-charge region well past the one sun maximum power point. This has the effect of lowering the cells output power and open circuit voltage. Single crystal cells are dominated by recombination within the quasi-neutral regions at the one sun maximum power point and, consequently, the fill factor and open circuit voltage are greater. Additionally, some preliminary measurements of the spatial dependence of diffusion length were made, Laue X-ray diffraction study of crystal orientations was performed and some SEM micrographs of polycrystalline wafers were taken.

51247 (JPL-PUB—79-38) **High-efficiency thin-film GaAs solar cells. Final report.** Stirn, R.J. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Apr 1979. Contract EG-77-A-29-1074. 98p. P 05/MF A01.

Results of a solar cell research task to demonstrate the feasibility of producing high-efficiency (15% or greater) thin-film GaAs solar cells with costs suitable for terrestrial power generation are reported. The approach is that of growing GaAs by organometallic chemical vapor deposition on recrystallized Ge films previously deposited on metal substrates, and fabricating AMOS solar cells on the GaAs. Studies of the interfaced oxide layer of AMOS single-crystal solar cells are reported. Several oxides were investigatd using a 50-watt CO_2 laser. Experiments with Ga/Ag SB metallization for stability testing were inconclusive. Continuing life testing experiments at elevated temperatures show promising results. Germanium recrystallization studies and GaAs growth on Ge layers is reported. Studies of AMOS solar cells made on polycrystalline GaAs thin films are presented. (SPH)

51248 (SAN—0113-T3) **Low cost solar cells based on amorphous silicon electrodeposited from organic solvents. Technical quarterly progress report 2, December 1, 1978—February 28, 1979.** Kroeger, F.A. (University of Southern California, Los Angeles (USA). Dept. of Materials Science). 1979. Contract EY-76-S-03-0113-040. 5p. P 02/MF A01.

Electrodeposition studies using three possible silicon sources are reported. Improvements of the apparatus for the cathodic deposition of a-Si with the exclusion of air are discussed. Experiments are described which attempt to characterize the structure of the deposits. These include mass spectroscopy and x-ray diffraction analysis. Work for the next quarter is previewed. (SPH)

51249 (SAN—1282-3) **Heterostructure single crystal silicon photovoltaic solar cells. Third quarterly report, April 1—June 30, 1977.** Szedon, J.R.; Temofonte, T.A.; Fonash, S.J. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 11 Sep 1978. Contract EY-76-C-03-1282. 46p. P 03/MF A01.

Cells of the Al—SiO_2—pSi type were made having electrical contact at their peripheries with large area n-p junctions. A model for the behavior of these devices was developed to treat their current—voltage behavior on illumination with the peripheral area

masked. Open circuit voltage dependence on illumination level can be misinterpreted as indicating high values of diode ideality factor (n) associated with thermionic emission affected by a high density of interface states. Illuminated current—voltage characteristics of conventional cells (no peripheral n-p junctions) were taken for $25^{\circ}C < T < 100^{\circ}C$. Neither thermionic emission of majority carriers into the oxide nor diffusion of minority carriers in the p-base region account for the observed dependence of open circuit voltage on temperature, although the latter does yield a value for temperature sensitivity which is reasonable. Studies of Au—SiO_2—nSi cells have been made to evaluate Schottky barrier height values by photoemission and by capacitance-voltage behavior. The results agree with earlier descriptions of majority carrier thermionic emission as being the mechanism which determines open circuit voltage.

51250 (SAN—1282-4) **Heterostructure single crystal silicon photovoltaic solar cells. Fourth quarter report, July 1—September 30, 1977.** Szedon, J.R.; Temofonte, T.A.; Dickey, H.C.; Fonash, S.J. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 18 Sep 1978. Contract EY-76-C-03-1282. 32p. P 03/MF A01.

Studies have been made of the sensitivity of the behavior of Al—SiO_2—pSi cells to details of formation of the back ohmic contact. Equivalently good behavior is obtained with aluminum or Ti—Pd—Au applied, without sintering, to a lapped, freshly etched back surface of the wafer. Good results for short circuit current enhancement with thermally evaporated films of Ta_2O_5 as AR coatings have been obtained. Electron beam evaporated films of Ta_2O_5 and spun-on films of TiO_2 from a liquid organometallic precursor give much lower open circuit voltage, due to ionizing radiation damage in the former instance and chemical interactions on baking in the latter case. Successful thinning of 80A thick Al films has been done by slow ($\sim$ 2A/min) etching in 1% H_2SO_4 without affecting diode opposing current or open circuit voltage. Chemically treated and AR coated cells have been prepared with conversion efficiency (for the optically active area) of 11% on cells of nominal 0.1 cm^2 area. A summary of the program status after the first year of work is given.

51251 (SAN—1283-9) **Heterostructure single crystal silicon photovoltaic cell: extension. Type A, semiconductor heterojunction silicon devices. Final report, May 15—August 10, 1978.** Ghosh, A.K.; Feng, T.; Fishman, C. (Exxon Research and Engineering Co., Linden, NJ (USA). Government Research Lab.). 1978. Contract EY-76-C-03-1287. 50p. P 03/MF A01.

Four areas of the technical task are reported: 1)device fabrication: involves fabrication of SnO_2/Polycrystalline solar cells; 2) phenomenological and theroetical analysis; 3) degradation mechanism; and 4) encapsulation and life testing. The status of each project is reported.

51252 (SAN—1287-2) **Thin films of silicon on low-cost substrates. Final report.** Sarma, K.R.; Gurtler, R.W.; Baghdadi, A.; Cota, M.; Ramsey, W.C. (Motorola, Inc., Phoenix, AZ (USA)). 1978. Contract EY-76-C-03-1287. 89p. P 05/MF A01.

The main objective of this research program is to develop a new method of depositing thin films of polycrystalline silicon, utilizing an Energy Beam, for producing solar cells capable of meeting the long range economic and performance objectives of the D.O.E.'s National Photovoltaics Program. The overall process being investigated involves: 1) depositing microcrystalline silicon films on temporary (reuseable) substrates efficiently using the Energy beam, 2) grain enhancing the separated microcrystalline silicon films to produce a macrocrystalline (large grain) structure by RTR laser recrystallization, and 3) fabricating solar cells on the grain enhanced silicon films. Progress is reported.

51253 (SAN—1577-3) **Cadmium sulfide/copper sulfide heterojunction cell research. Technical progress report No. 2, January 1—March 31, 1978.** Szedon, J.R.; Shirland, F.A.; Biter, W.J. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 9 Aug 1978. Contract EG-77-C-03-1577. 36p. P 03/MF A01.

Poor adhesion of CdS films to zinc-plated copper foil substrates has been eliminated by depositing somewhat thinner films than earlier and by using the mat (as opposed to the smooth) side of the electroformed copper foil for deposition. Particle spatter effects have been reduced and cells of 4 cm^2 area have been produced with average efficiency of 5.4%. Use of Zn—plated Cu, Mo, Zn—plated Mo and glass substrates appears to influence the etching behavior of CdS films in dilute chromic acid. The results suggest a sensitivity to the presence of zinc. Laser scanned reflection and photocurrent response studies reveal some influence of substrate morphology. Direct correlations are weak, presumably because of strong local variations in topography, due to texturing and in carrier transport or junction collection efficiency. Similar types of studies on single crystal-based cells have established the feasibility of using localized photoresponse to characterize minority carrier transport in special test structures. Compositional analysis of Cu_2S layers on single crystal CdS have been attempted using ESCA and ion etching methods. A major problem is the formation of copper nodules, presumably due to the ion etching method, which do not permit obtaining a true profile of this element. Films of (Zn/sub x/Cd/sb 1-x/)S alloys, deposited using electron beam evaporation, have been made with composition corresponding to that of the evaporant sources.

51254 (SAND—78-7027) **Design and development of a 300-watt solar photovoltaic concentrator. Final report, May 17, 1976—November 30, 1977.** Napoli, L.S.; Swartz, G.A. (RCA Labs., Princeton, NJ (USA)). Jun 1978. Contract EY-76-C-04-0789. 107p. P 06/MF A01.

The design, fabrication and performance of high level concentration (300X) with refractive lenses on small silicon solar cells $\sim$ (0.4 cm^2) with passive cooling are described. Four systems were fabricated using polar axis (2-axis) tracking. Two systems were rated at 100 W peak, and two were rated at 300 W peak. The maximum power measured on the 300-W unit was 236 W at 93 mW/cm^2 direct insolation. Solar cells were designed and fabricated using bulk high resistivity n-type silicon which showed a maximum efficiency of 17.5% independent of concentration level from 50 to 400X. At 1000X, the efficiency dropped to 14%. Lens arrays made from vacuum formed shells and epoxy filled showed good performance on a selected basis but nonuniformity and uv degradation dictated a change to Fresnel lenses. The Fresnel lens arrays are approximately 83% efficient but the imaging was quite nonuniform causing degradation in cell fill factor and collection efficiency. Heat transfer calculations and simulations show that the cell temperature is about 25 to $35^{\circ}C$ above ambient temperature. Thermal spreading of the heat from the cell area to an area equivalent to the lens area is the most important function of the heat sink. The addition of fins do not significantly reduce cell operating temperature. An optimization analysis was performed on passively cooled photovoltaic concentrators showing the various tradeoffs that exist with lens size and concentration level. The conclusions are that minimum manufacturing costs of $0.70/peak watt can be obtained at an optimum lens size of approximately 100 cm^2 and concentration level of 100 suns. Deviation from this optimum either degrades performance, increases cost, or both.

51255 (SAND—79-1316) **Bibliography of reports by the Sandia photovoltaic projects.** Schueler, D.G. (Sandia Labs., Albuquerque, NM (USA)). Aug 1979. Contract EY-76-C-04-0789. 21p. P 02/MF A01.

Sandia Laboratories manages the Systems Definition and Development and the Photovoltaic Concentrator Technology Development projects of the US Department of Energy's Photovoltaics Program. Technical information developed by these projects is disseminated through technical publications workshops, presentations at technical meetings, and contractor reports. This document, which is a compilation of photovoltaic reports and publications by Sandia Laboratories and its contractors, is provided as a convenient reference to workers in photovoltaic technology. It is in chronological order.

51256 (SAND—79-7021) **Silicon concentrator solar cell manufacturing development.** Wrigley, C.; Storti, G.; Wohlgemuth, J. (Solarex Corp., Rockville, MD (USA)). Nov 1978. Contract EY-76-C-04-0789. 69p. P 04/MF A01.

The program to design and develop the manufacturing technology for silicon solar cells sutiable for low-cost photovoltaic concentrator systems is summarized. Detailed discussions are presented for the following tasks: concentrator design, manufacturing process development, solar cell measurement and evaluation, results experienced in cell manufacturing, and production cost estimates. Several program conclusions and recommendations are given. In particular, it is found that (1) large-area concentrator cells with 15% efficiency at 50 suns are readily manufacturable; (2) DOE cost goals for 1981 to 1982 can be met today with market volumes at 200 to 1000 m^2 per year; and (3) respectable manufacturing yields are achievable with the technology now developed.

51257 (SAND—79-7040) **Novel concentrator photovoltaic converter system development. Final report.** Bedair, S.M.; Lamorte, M.F.; Hauser, J.R. (Research Triangle Inst., Research Triangle Park, NC (USA)). Jul 1979. Contract EY-76-C-04-0789. 207p. P 10/MF A01.

The long-range objective of this work is to develop, synthesize and evaluate a novel cascade solar cell having an AM 1 conversion efficiency of 30 percent or greater and capable of operating at both high illumination levels and elevated temperatures. The first year's work has been oriented toward demonstrating the cascade solar cell concept whereby two cells are internally connected in a monolithic structure to provide a voltage aiding series arrangement of the cells. Accomplishments during the first year include studies of the lower bandgap cell, the upper bandgap cell and the low impedance connecting junction. the material systems studied include GaInAs, AlGaAs, GaInP and AlGaInAs. The major accomplishment of the work has been the first experimental demonstration

of a cascade solar cell structure in the GaAs/AlGaAs materials system. Test cells have demonstrated open circuit voltages as high as 2.2 volts and efficiencies in the 10 to 15% range without antireflecting layers.

51258 (SERI/TP—51-314) **Photovoltaic markets: a review and assessment.** Posner, D.M. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1979. Contract EG-77-C-01-4042. 6p. (CONF-790541—46). P 02/MF A01.

From International Solar Energy Society meeting; Atlanta, GA, USA (28 May 1979).

Available information on potential markets for photovoltaic power systems is reviewed. A set of key parameters which affect the rate of photovoltaic market penetration is used to develop a simple anaytical structure that characterizes potential markets. Completed studies on photovoltaic markets were reviewed to describe potential markets using this structure. Selected markets were then examined in greater detail in a market demand workshop attended by potential purchasers in these markets. Available information, while sufficient to provide a rudimentary indication of how markets might develop, does not allow the construction of any single market scenario in which a high level of confidence can be placed. Major uncertainties in the available information on photovoltaic markets are highlighted.

51259 (TID—28931) **Heterostructure single crystal silicon photovoltaic solar cells. Fifth quarterly report, October 1—December 31, 1977.** Szedon, J R.; Temofonte, T.A.; Fonash, S.J.; Sullivan, T.E. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center; Pennsylvania State Univ., University Park (USA)). 9 Oct 1978. Contract EY-76-C-03-1282. 63p. P 04/MF A01.

The performance of MIS solar cells of the Al—qcSiO$_2$—pSi type has been enhanced by exposure to vapors of hydrofluoric acid. Open circuit voltage enhancement by about 10% to values of near 530 mV involves reduction of cell current opposing collected photocurrent. Short circuit enhancement by about 50% appears to be due to thinning of the thin aluminium electrode. Exposure to ambient water vapor results in loss of open circuit voltage and increased series resistance, but in a dry nitrogen ambient this does not occur. MIS cells made on polycrystalline silicon substrates generally exhibited behavior comparable to those on single crystal substrates but several cells had high values of n-factor (2 to 3), possible indicating grain boundary recombination influences. A summary is given of work done over a one year period at the Pennsylvania State University, treating basic mechanisms in MIS and Schottky barrier cells on n-type substrates. Three metals (Au, Pd, and Ag) were used. The differences in electronic and physical details of the cells and structures using these materials are discussed.

51260 Gallium arsenide films and solar cells on graphite substrates. Chu, S.S.; Chu, T.L.; Lan, M.S. (Southern Methodist University, Dallas, Texas 75275). *J. Appl. Phys.;* **50**: No. 9, 5805-5809(Sep 1979).

Gallium arsenide films have been deposited on graphite substrates by the reaction of gallium, hydrogen chloride, and arsine in a hydrogen flow. The structural and electrical properties of gallium arsenide films have been investigated. The interface between undoped gallium arsenide and graphite exhibits rectifying characteristics; however, a heavily doped interlayer reduces the interface resistance to a tolerable level. MOS-type solar cells prepared from n-GaAs/n$^+$-GaAs/graphite structures have AM1 efficiencies of higher than 6%.

51261 Photovoltaic effect in CdS/Cu$_2$S solar cells. Boeer, K.W. (Univ.. of Delaware, Newark). pp 423-453 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

The photovoltaic effect in heterojunctions is explained using the example of the CdS/Cu$_2$S solar cell. Here both cell parts, the Cu$_2$S emitter, responsible for current generation, and the CdS collector, with the junction almost completely located in the CdS and responsible for the voltage drop, are well separated from each other, hence permitting a more transparent analysis. A recently developed self-consistent physical model which permits a quantitative description of the current-voltage characteristics is reviewed and extended.

BIOMASS PRODUCTION AND CONVERSION

REFER ALSO TO CITATION(S) 51196, 51197, 51198, 51200, 51201, 51202, 51204

51262 (SERI/TP—49-183) **Retrofit '79 .** (Solar Energy Research Inst., Golden, CO (USA)). 1979. Contract EG-77-C-01-4042. 197p. (CONF-790206—). P 09/MF A01.

From Biomass gasification workshop; Seattle, WA, USA (2 Feb 1979).

In addition to a compilation of the talks presented, summaries are given of panel discussions on the commercialization of air gasifiers and on the research needs in this area. Suggestions made in response to a letter asking what government actions were needed to promote commercialization of air gasification are summarized. A directory is given of air biomass gasifiers in the US and Canada and their status (research, pilot scale, commercial, etc.). Separate abstracts were prepared for eight papers. (JSR)

51263 Petroleum plantations. Calvin, M. (Univ. of California, Berkeley). pp 687-705 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Photosynthesis is examined as a possible annually renewable resource for material and energy. The production of fermentation alcohol from sugar cane as a major component of materials for chemical feedstocks is examined as well as the direct photosynthetic production of hydrocarbon from known plant sources. Experiments are underway to analyze the hydrocarbons from Euphorbias, Asclepias, and other hydrocarbon-containing plants with a view toward determining their various chemical components. In addition, experimental plantings have begun to obtain data on which species would be the most successful. Work is also underway on the development of chemical-process techniques for extraction of plant materials after harvesting. Indications are that a yield of approximately ten barrels per acre in a seven-month growing period on semiarid land may be expected. In addition, efforts are being made to construct synthetic systems on the basis of knowledge of the natural photosynthetic processes. These systems could be used to produce fuel, fertilizer, and power. As a result of studies of the natural quantum conversion process in green plants we can envisage several photoelectron transfer processes, some of which have already been demonstrated in synthetic systems. Methods of constructing system of this type and the principles of their use are described.

51264 Marine photosynthetic microorganisms as potential energy resources: research on nitrogen fixation and hydrogen production. Mitsui, A. Miami, FL; University of Miami (1978). 25p. (CONF-7809116—1). Univ. of Miami, School of Marine and Atmospheric Science, Miami, FL.

From 5. international ocean development conference; Tokyo, Japan (25 Sep 1978).

The future applications of marine photosynthetic microorganisms in solar energy-based energy producing technologies are discussed. Marine microorganisms represent a potential source of several different forms of renewable energy, including combustible fuels, fertilizers (in the form of combined nitrogen), chemicals, and food. Special emphasis is given to two aspects of utilization of marine photosynthetic microorganisms; biological nitrogen fixation, and hydrogen production. The approach, results, and implications of the experimentation presently underway at the University of Miami Marine School are reviewed. These results indicate that there is a definite potential for the successful utilization of marine blue-green algae for the production of hydrogen fuel, combined nitrogen fertilizer through nitrogen fixation, and food.

PHOTOVOLTAIC POWER PLANTS

51265 (COO—4094-25) **Classification and technical review of dc-ac inverters for use in photovoltaic power systems.** Landsman, E.E. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 30 Apr 1979. Contract EY-76-C-02-4094. 37p. P 03/MF A01.

A classification system is presented for stand-alone and utility-interactive dc-to-ac inverters used in photovoltaic systems in the 1-to-100-kVA power range. Additional inverter topologies, noted during the classification process, are introduced. To provide background, generally used dc-to-ac inversion technology is reviewed. Relative merits and liabilities of available power devices are discussed and device protective techniques are reviewed. Maximum power point tracking can enhance system value in utility-interactive no-battery photovoltaic power systems. This general theory is reviewed and an improved implementation is described.

51266 (DOE/CS/34267—1) **Photovoltaic concentrator application experiment, Phase I: a 150 KW photovoltaic concentrator power system for load-center applications with feedback into the utility grid. Final report, June 1, 1978—March 31, 1979.** Noel, G.T.; Alexander, G.; Stember, L.H.; Stickford, G.H.; Smail, H.E.; Broehl, J.H.; Carmichael, D.C. (Battelle Columbus Labs., OH (USA)). Apr 1979. Contract ET-78-C-04-4267. 123p. P 06/MF A01.

A 150-kW-peak concentrator-type photovoltaic power system to supply a multiple building load application in the Columbus, Ohio area was designed and analyzed by a Battelle-led team. The system will operate in parallel with the utility grid (which provides backup power) to supply either or both of two service/commercial buildings and will feed surplus power into the utility grid. The array consists of fifteen 10-kW carousel-mounted subarrays which are two-axis tracking. The subarrays each consist of 40 passively cooled concen-

trating modules which incorporate a primary parabolic trough reflector and a secondary compound-elliptic concentrator to achieve a geometric concentration ratio of ~ 26. The power conditioning subsystem is microprocessor controlled, with maximum-power-point tracking and automatic control capabilities. The system performance analysis indicates that the system will supply approximately 147,000 kWh/year to the primary load and an additional 55,000 kWh/year to the utility grid, in the single-load operational mode. The system design and the daily and seasonal match of system output with the load are described in detail. Plans are also discussed for installation and for operational evaluations of performance, economics, and institutional issues.

51267 **Status of photovoltaic systems and applications.** Schueler, D.G. (Sandia Labs., Albuquerque, NM). pp 621-628 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Solar photovoltaic conversion systems, based on the direct conversion of solar energy to electricity through the use of solar cells, have the potential of providing a significant source of clean and renewable energy in a variety of applications. The Department of Energy's Photovoltaic Conversion Program is a multifaceted approach emphasizing the development of low-cost and reliable photovoltaic systems and the fielding of applications experiments to produce data on the performance and reliability of such systems. This paper discusses results of system conceptual design and analysis studies for residential and central generation stations. A number of currently operating and planned application experiments ranging in size from a few hundred watts to 0.5 megawatts are also reviewed.

SOLAR THERMAL POWER PLANTS

51268 (DOE/ET—0078/T1) **Solar thermal power systems. Annual technical progress report, FY 1978.** (Department of Energy, Washington, DC (USA). Office of Solar, Geothermal, Electric and Storage Systems). Jun 1979. 144p. P 07/MF A01.

A technical progress report on the DOE Solar Thermal Power Systems Program is given. Emphasis is on the technical progress of the projects rather than on activities and individual contractor efforts. Each project description indicates its place in the prior to FY 1978 is given; the significant achievements and real progress of each project during FY 1978 are described; and future project activities as well as anticipated significant achievements for each project are forecast. (WHK)

51269 (DOE/SF/10505—1) **Solar thermal electric plants in hydroelectric grid. Technical progress report, February 9, 1979—May 9, 1979.** (Bureau of Reclamation, Boulder City, NV (USA)). 17 Jul 1979. Contract AI03-79SF10505. 26p. P 03/MF A01.

The Solar Thermal Electric Plant in Hydroelectric Grid study is a joint effort between the Bureau of Reclamation's (BUREC), Lower Colorado Region and the Engineering and Research Office (E and R) Center in Denver. During the course of the study the technical and economic assessment of operating a solar power plant in conjunction with the BUREC hydroelectric system in the Southwest will be investigated. The study will examine the hydrologic impacts of integrating a solar power plant into the hydroelectric system. Investigations into the size, cost, and operation of advanced solar systems will also be included in the study. In addition, energy costs, the potential penetration of solar plants into the system, and selection of candidate sites for building the system will be studied. Site selection studies are nearing completion. All factors have been selected that will be used in the candidate site selection. The factor maps have been compiled and will be drafted to finished copies. The final grading procedures to select candidate sites are presently being completed. The hydrologic model of the river/reservoir system is being developed using Streamflow Synthesis and Reservoir Regulation (SSARR). The initial performance and cost data have been reviewed for three solar power systems. The systems under review are the designs of General Electric (GE), Atomics International (AI), and Martin Marietta (MMC). Two of the systems, the GE and MMC systems are under consideration at this time. Future efforts will include the completion of the site selection, running an operational study of the river/reservoir system with flows modified to reflect the impact of a solar power plant, and to perform solar power plant sensitivity studies.

CENTRAL RECEIVER

REFER ALSO TO CITATION(S) 51227

51270 (EUR—6116-EN) **Solar gas turbine.** Angelini, A. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1978. 9p. U 02/MF A01.

The thermal cycle described refers to a solar power plant (field of mirrors reflecting on a central receiver) coupled with a gas turbine. The originality of the plant consists in having divided the receiver (put at the top of the solar tower) into two parts, connected with the first and the second stage of the turbine respectively. This allows a thermal cycle with gas reheating and hence high values of the thermal efficiency.

51271 (SAND—79-1588C) **Central receiver test facility control and data systems.** Davis, D.B. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 9p. (CONF-791005—1). P 02/MF A01.

From ISA national conference; Chicago, IL, USA (22 Oct 1979).

The central Receiver test Facility (CRTF) is the primary solar test facility for the Department of Energy and is operated by Sandia Laboratories, Albuquerque, New Mexico. The multiple minicomputer control and data systems utilized in CRTF are described.

51272 (TID—29434(Vol.1)) **ERDA 10 MWe solar pilot plant subsystem research experiments, steam generator tests at Northern States Power Riverside Station. Volume I. Test description and data submittal.** (Honeywell, Inc., Minneapolis, MN (USA). Energy Resources Center). Apr 1977. Contract EY-76-C-03-1109. 131p. P 07/MF A01.

In the spring of 1977 a 5 MW SRE steam generator, a scaled-down version of the Pilot Plant steam generator, was tested at the Riverside Station of Northern States Power Company in Minneapolis. This report, in eight volumes, describes that test program and submits test data. Specifically, Volume I contains the test description including installation, instrumentation and data handling, test objectives, results commentary and data analysis. Volumes II through VIII are test data logs for Tests 17 through 23. These include all performance testing specified by the steam generator manufacturer (whereas previous testing was primarily given over to equipment checkout and proving of the test installation). The tests include steady-state, transient, trip simulation and asymmetric heat/input modes of operation. The testing was done in a vacant location of the turbine room at Riverside using available services: feedwater, condensate water, cooling water, instrument air, condenser cooling water discharge, low-voltage and 13.8 KV power. Heating of the steam generator was done using a radiant array consisting of quartz-iodine heat lamps to simulate reflected solar radiation. Steam raised in the steam generator was exhausted to ambient through the condenser cooling water discharge of an adjacent power generating unit. Heat balance calculations over the range of loads run indicate that about 70 percent of the input power going to the radiant array was absorbed by the steam generator, about 24 percent was absorbed by the cooling water going to the radiant array, and about 5 percent was unaccounted for.

51273 (TID—29434(Vol.2)) **ERDA 10 MWe solar pilot plant subsystem research experiments, steam generator tests at Northern States Power Riverside Station. Volume II. Test No. 17.** (Honeywell, Inc., Minneapolis, MN (USA). Energy Resources Center). 13 Apr 1977. Contract EY-76-C-03-1109. 233p. P 11/MF A01.

In the spring of 1977 a 5 MW SRE steam generator, a scaled-down version of the 10 MW Solar Pilot Plant steam generator, was tested at the Riverside Station of Northern States Power Company in Minneapolis. Detailed test results are presented for test No. 17, performed April 13, 1977. The test objectives were: (1) to achieve steady state operating conditions with outlet steam at 960°F, at approximately 10,000 PPH steam flow; (2) to perform the following transient tests: (a) main steam step, (b) radiant array step, and (c) drum level shrink-and-swell; and (3) to perform a power trip under automatic control. (WHK)

51274 (TID—29434(Vol.3)) **ERDA 10 MWe solar pilot plant subsystem research experiments, steam generator tests at Northern States Power Riverside Station. Volume III. Test No. 18.** (Honeywell, Inc., Minneapolis, MN (USA). Energy Resources Center). 15 Apr 1977. Contract EY-76-C-03-1109. 239p. P 11/MF A01.

In the spring of 1977 a 5 MW SRE steam generator, a scaled-down version of the 10 MW Solar Pilot Plant steam generator, was tested at the Riverside Station of Northern States Power Company in Minneapolis. Detailed test data are given for test No. 18, performed on April 15, 1977. The test objectives were to perform the following transient tests: (a) power ramp transient; (b) cloud obstruction transient; (c) attemperator step transient; and (d) 67% step power increase transient. (WHK)

51275 (TID—29434(Vol.4)) **ERDA 10 MWe solar pilot plant subsystem research experiments, steam generator tests at Northern States Power Riverside Station. Volume IV. Test No. 19.** (Honeywell, Inc., Minneapolis, MN (USA). Energy Resources Center). 18 Apr 1977. Contract EY-76-C-03-1109. 167p. P 08/MF A01.

In the spring of 1977 a 5 MW SRE steam generator, a scaled-down version of the 10 MW Solar Pilot Plant steam generator, was tested at the Riverside Station of Northern States Power Company

in Minneapolis. Detailed test procedures and results are presented for test No. 19, performed on April 18, 1977. The test objectives were: (1) to perform the following trip tests: (a) recirculation pump trip, (b) feedwater pump trip; (2) to operate the recirculation pump at various flow rates to demonstrate pump instability at flow rates above 100,000 PPH; (3) to obtain steady state data at several conditions; and (4) to perform a 40% step power increase transient. (WHK)

51276 (TID—29434(Vol.5)) **ERDA 10 MWe solar pilot plant subsystem research experiments, steam generator tests at Northern States Power Riverside Station. Volume V. Test No. 20.** (Honeywell, Inc., Minneapolis, MN (USA). Energy Resources Center). 19 Apr 1977. Contract EY-76-C-03-1109. 185p. P 09/MF A01.

In the spring of 1977 a 5 MW SRE steam generator, a scaled-down version of the 10 MW Solar Pilot Plant steam generator, was tested at the Riverside Station of Northern States Power Company in Minneapolis. Detailed results are presented for test No. 20, performed on April 19, 1977. The test objectives were: (1) to perform the following trip tests: (a) heliostat trip - decay to 800°F main steam temperature, (b) heliostat trip - decay to 700°F main steam temperature, and (c) heliostat trip - decay to 595°F main steam temperature; (2) to perform the shrink and swell transient with a 225-second delay until automatic control; and (3) to tune the attemperator automatic control system. (WHK)

51277 (TID—29434(Vol.6)) **ERDA 10 MWe solar pilot plant subsystem research experiments, steam generator tests at Northern States Power Riverside Station. Volume VI. Test No. 21.** (Honeywell, Inc., Minneapolis, MN (USA). Energy Resources Center). 22 Apr 1977. Contract EY-76-C-03-1109. 280p. P 13/MF A01.

In the spring of 1977 a 5 MW SRE steam generator, a scaled-down version of the 10 MW Solar Pilot Plant steam generator, was tested at the Riverside Station of Northern States Power Company in Minneapolis. Detailed results of test No. 21, performed on April 21, 1977, are presented. The test objectives were to perform the asymmetric heating tests (with the solar simulator offset within the cavity) at three different power levels. (WHK)

51278 (TID—29434(Vol.7)) **ERDA 10 MWe solar pilot plant subsystem research experiments, steam generator tests at Northern States Power Riverside Station. Volume VII. Test No. 22.** (Honeywell, Inc., Minneapolis, MN (USA). Energy Resources Center). 26 Apr 1977. Contract EY-76-C-03-1109. 286p. P 13/MF A01.

In the spring of 1977 a 5 MW SRE steam generator, a scaled-down version of the 10 MW Solar Pilot Plant steam generator, was tested at the Riverside Station of Northern States Power Company in Minneapolis. Complete test results are reported for test No. 22, performed on April 26, 1977. The test objectives were: (1) to reperform the transient tests: (a) main steam step, (b) radiant array step, (c) drum level shrink and swell, (d) radiant array ramp, (e) cloud disturbance; and (2) to take steady state data at several power levels. (WHK)

51279 (TID—29434(Vol.8)) **ERDA 10 MWe solar pilot plant subsystem research experiments, steam generator tests at Northern States Power Riverside Station. Volume VIII. Test No. 23.** (Honeywell, Inc., Minneapolis, MN (USA). Energy Resources Center). 28 Apr 1977. Contract EY-76-C-03-1109. 266p. P 12/MF A01.

In the spring of 1977 a 5 MW SRE steam generator, a scaled-down version of the 10 MW Solar Pilot Plant steam generator, was tested at the Riverside Station of Northern States Power Company in Minneapolis. Detailed test data are presented for test No. 23, performed on April 28, 1977. The test objectives were: (1) to take steady state heat balances at several points including maximum possible power, (2) to bring boiler to rated pressure at maximum rate, and (3) to monitor parameters while bottled up with array down. (WHK)

51280 10-megawatt solar-central-receiver pilot plant. Rasband, J.L. (Southern California Edison Co., Rosemead). pp 618-620 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Through a cooperative effort of government and private industry, a 10-megawatt solar thermal pilot plant is to be constructed in the 1980 to 1981 time frame using central receiver technology. The pilot plant will be tested for five years and information derived will be used for future commercial solar-generating stations.

51281 Central receiver solar thermal power system. Gervais, R.L.; Hallet, R.W. Jr. (McDonnell Douglas Astronautics Co., Huntington Beach, CA). pp 455-469 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

An overview of a central receiver solar thermal electric system presently being developed for the United States Department of Energy is presented. The design is distinct in that it uses (1) centrally supported, low-cost heliostats, (2) an external single pass-to-superheat receiver, and (3) a sensible heat, thermocline-type thermal storage. In its commercial version, the system is capable of producing 100 MWe and is designed to accommodate peak to intermediate plant operational modes. The principal working medium is water-steam. The system is designed for a 30-year operational life with a 90% plant availability goal. The definition of a 10-MWe Pilot Plant is also presented. The purpose of the Pilot Plant is to operate a system which demonstrates technical feasibility and provides an indication of system economics for the Commercial-size system.

TOTAL ENERGY AND HYBRID SYSTEMS

51282 (ORNL/Sub—7525/2) **Solar total energy systems (STES) simulation program user's guide.** Timmer, B.R. (Aerospace Corp., El Segundo, CA (USA). Information Processing Div.). 4 Jan 1979. Contract W-7405-ENG-26. 89p. (ATR—79(7748)-2). P 05/MF A01.

A computer program which simulates the operations of a STES facility and evaluates its annualized costs and energy displacement is described. The program contains a dynamic model which simulates the interaction of the insolation and electrical and thermal demands on an hourly basis. The program is flexible enough to allow thousands of different configurations to be simulated under a wide variety of conditions. Moreover, with this program, the sizes of the STES components can be adjusted to maximize the return on invested capital or the savings in fossil fuels. The program can also be used to simulate conventional fossil fuel Total Energy (TE) systems and solar thermal energy systems for comparison with STES. The program is written in Fortran for the FTN compiler on The Aerospace Corporation's CDC 7600 computer. It consists of 9 routines and approximately 1300 cards, including comments. A description of the program, its inputs and its outputs are presented. Examples of program input and otput as well as a sample deck structure are provided. A source listing appears in the appendix.

51283 (ORNL/Sub—7525/4) **Market Penetration Model (MPM) user's guide.** Timmer, B.R. (Aerospace Corp., El Segundo, CA (USA). Information Processing Div.). 4 Jan 1979. Contract W-7405-ENG-26. 59p. (ATR—79(7748)-4). Dep. NTIS, PC A04/MF A01.

This document describes a computer program which calculates the most probable Solar Total Energy System (STES) market penetration and forecasts of energy displacement by geographic location (50 states) and by industrial application (140 industries) for seven time periods (from 1985 to 2015 in five year increments). The program is written in Fortran for the FTN compiler on The Aerospace Corporation's CDC 7600 computer. It consists of approximately 750 cards, including comments. This document contains a description of the program, its inputs and its outputs. Examples of program input and output as well as a sample deck structure are provided. A source listing appears in the appendix.

51284 Solar total energy systems. Whaley, T.P. (Inst. of Gas Technology, Chicago, IL). pp 471-500 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

Solar total energy (STE) systems are solar-electric systems that utilize reject heat from the heat engine or photovoltaic array to provide thermal energy to an application. They can be used to provide (in addition to electricity) space heating, space cooling, and hot water to residential, commercial, or institutional applications, or process steam to industrial applications. Capital costs are high, however, and considerable reductions in the costs of solar collectors, heat engines, and photovoltaic arrays will be required before market penetration can occur. Market penetration is expected first in the industrial sector, and could occur as early as 1990 to 1995 if projected reductions in the cost of central receiver systems take place.

OCEAN THERMAL GRADIENT POWER PLANTS

51285 (CONF-780934—) **Report of the proceedings of the OTEC alternate cycles contractors' information exchange meeting.** Chen, F.C.; Michel, J.W. (comps.). (Oak Ridge National Lab., TN (USA)). Dec 1978. Contract W-7405-ENG-26. 210p. P 10/MF A01.

From OTEC alternate cycles contractors' information exchange meeting; Washington, DC, USA (26 Sep 1978).

Separate abstracts were prepared for the seven papers presented. (WHK)

51286 (CONF-780934—, pp 1-4) **OTEC Biofouling and Corrosion Testing Program.** Kinelski, E.H. (R and D associates, Marina del Ray, CA). Dec 1978.

From OTEC alternate cycles contractors' information exchange meeting; Washington, DC, USA (26 Sep 1978).

The success of an OTEC power system is heavily materials oriented. The unprecedented requirement for high heat transfer and massive size of the OTEC heat exchangers has stimulated a test program where emphasis is placed on studies of heat transfer, corrosion, biofouling and its countermeasures, and materials selection. The OTEC hardware development program ranges from testing heat transfer by single tubes, to small multi-tube heat exchangers, and in large 1 MWt and 1 MWe core test units. The OTEC Seacoast Test Facility planned for start-up in the summer of 1979 offers an opportunity to consolidate all component development and testing.

51287 (CONF-780934—, pp 7-43) **Mist flow OTEC process.** Ridgway, S. (R and D Associates, Marina del Ray, CA). Dec 1978.

From OTEC alternate cycles contractors' information exchange meeting; Washington, DC, USA (26 Sep 1978).

The goal of this project is to determine the feasibility of the mist flow ocean thermal energy process. Essential components of the system are to be developed and tested. The fluid dynamics of the two-phase flow that takes place in the lift tube should be understood in sufficient depth and detail to enable reasonable projections of the operating characterics and the boundaries of the possible capital costs of a mist flow ocean thermal energy plant. The influence of mist parameters (droplet size, droplet size distribution) and transport parameters (pressure gradient, duct profile and velocity schedule) on the lift effectiveness of the two-phase flow is to be determined. Progress is reported. The thermodynamic analysis of the mist flow process is complete. The two-phase flow has been analyzed on the assumption of constant lift effectiveness and preliminary choices of possible duct area profiles, injection velocity and flow velocity schedule made on this basis. The results of this analysis were used for the technical assessment. The mist generator design is ready. The mist generator has been operated in air. Next on the schedule is the operation of the mist generator and the operation of the mist transport phase in the vacuum. Systems analysis (technical assessment) shows that a low lift effectiveness does not raise capital costs excessively.

51288 (CONF-780934—, pp 45-99) **Design of a facility for laboratory experiments on a mist-flow energy extraction process.** Charwat, A.F. (Univ. of California, Los Angeles). Dec 1978.

From OTEC alternate cycles contractors' information exchange meeting; Washington, DC, USA (26 Sep 1978).

The two main objectives of the project are: 1) identifiy the unit processes of a Mist-lift OTEC cycle and assess the pertinent technical and scientific background; and 2) design an experimental facility which can serve as a test-bed for development of key components of the system and demonstrate the overall feasability of the Mist-lift cycle. Progress is summarized. (WHK)

51289 (CONF-780934—, pp 101-112) **Development and test of equipment for on-site measurement of sea water behavior in low temperature flash evaporators.** Watt, A.D.; Mathews, F.S. (Colorado School of Mines, Golden). Dec 1978.

From OTEC alternate cycles contractors' information exchange meeting; Washington, DC, USA (26 Sep 1978).

The project goals are to design, fabricate, and laboratory test an apparatus suitable for measuring rates of steam production from sea water at several potential OTEC sites for various flash evaporator configurations. The proposed test apparatus is described and the project status is summarized. (WHK)

51290 (CONF-780934—, pp 113-129) **Foam sea solar power plant.** Fort, T. Jr.; Zener, C.; Fetkovich, J. (Carnegie Mellon Univ., Pittsburgh, PA). Dec 1978.

From OTEC alternate cycles contractors' information exchange meeting; Washington, DC, USA (26 Sep 1978).

The purpose of the present program is to develop the Foam OTEC System as an attractive alternative to the closed cycle OTEC system. Since a preliminary survey of estimated costs looked favorable, a project was initiated to determine the technical feasibility. The present project reported upon was directed to establish this technical feasibility for the two most uncertain functions of a Foam OTEC system. The first function is to generate a stable foam rising at a rate comparable to the upper limit imposed by sonic velocity. This corresponds to a mass flow of $\sim$ 1 gram/cm^2 sec, which would give a power density of 1 kw/ft^2. The second function is to break the foam at the desired level. The project status is reviewed.

51291 (CONF-780934—, pp 131-151) **Sea water surfactant system and their variability in relation to the foam OTEC system.** Kay, M.I. (CEER-UPR, Mayaguez, Puerto Rico). Dec 1978.

From OTEC alternate cycles contractors' information exchange meeting; Washington, DC, USA (26 Sep 1978).

The project goals are 1) to establish variability of sea water surface properties around Puerto Rico; and 2) to attempt systematic minimization of surfactant concentrations necessary to transport sea water with the objective of establishing a valid estimate of surfactant costs. It is comtemplated to establish a set of possible compounds out of which, some of which will be chosen on the basis of economics (including possible recovery) and environmental acceptability. The project status is reviewed.

51292 (CONF-780934—, pp 153-216) **100 MWe OTEC Alternate Power Systems Study.** Sciubba, C. Jr. Dec 1978.

From OTEC alternate cycles contractors' information exchange meeting; Washington, DC, USA (26 Sep 1978).

The objective of the 100 MWe OTEC Alternate Power System Study is to provide conceptual power system designs for the open and hybrid OTEC cycles. The study objective is to treat, in depth, several identified problems such as flash evaporation, turbines, deaeration and heat exchangers. The implied objective of this study, as in all conceptual studies, is the definition of system costs and evaluation of those costs against other alternative systems. The project status s reported. The open cycle work is near completion requiring only the addition of the new deaeration and condenser corrections. Hybrid cycle work has been delayed and still requires work in ammonia evaporator design and overall optimization and systems. The current expected completion date is 12/15/78.

51293 (ORO—5165-1) **Development of plastic heat exchangers for ocean thermal energy conversion. Final report, August 1976—December 1978.** Hart, G.K.; Lee, C.O.; Latour, S.R. (DSS Engineers, Inc., Fort Lauderdale, FL (USA)). Jan 1979. Contract EY-76-C-05-5165. 133p. P 07/MF A01.

Materials and processes have been selected and design information obtained for plastic ocean thermal energy conversion (OTEC) heat exchangers as the result of a program comprising five types of laboratory experiments. Tests to evaluate the chemical resistance of seven commercially available thermoplastics to sea water and several possible working fluids were conducted with emphasis placed on compatibility with ammonia. Environmental rupture tests involving exposure of stressed specimens to sea water or liquid ammonia indicated that the high density polyethylene (HDPE) is the best suited candidate and produced an extrapolated 100,000 hour failure stress of 1060 psi for HDPE. Long term durability tests of extruded HDPE plate-tube panel confirmed that plastic heat transfer surface is mechanically reliable in an OTEC environment. Thermal conductivity measurements of acetylene black filled HDPE indicated that conductivity may be increased by 50% with a 35% by weight filler loading. The permeability coefficient measured for liquid ammonia through HDPE was higher than previous estimates. Test showed that the rate can be significantly reduced by sulfonation of HDPE. A review of biofouling mechanisms revealed that the permeable nature of the plastic heat exchanger surface may be used to control primary biofouling form formation by allowing incorporation of non-toxic organic repellents into the plastic. A preliminary design and fabrication development program suggests that construction of an ammonia condenser test unit is feasible using currently available materials and manufacturing techniques.

51294 **OTEC program status and plans.** Gronich, S. pp 554-575 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Significant tests have been conducted on the thermal performance of heat exchangers, biofouling rates, cleaning, and corrosion. Results of those tests are presented. In addition, major system studies are being conducted on the power subsystems, platform and cold water pipe, and electric cables. Subsystem cost goals are projected for each of these, and the relative economics of OTEC are compared with those of more traditional baseload power systems. Future program-plan options and assessments are presented.

51295 **Market penetration for OTEC.** Cohen, R. pp 576-587 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Technology for Ocean Thermal Energy Conversion power production is now being developed. Successful demonstration of this technology may be achieved by 1985, followed by construction of commercial OTEC power plants of about 400 MWe output. These plants will produce electricity for transmission to shore by submarine cable and for the production of energy-intensive products such as ammonia, hydrogen, and aluminum. There is a sizable ocean thermal resource available in the Gulf of Mexico at convenient cable

distances to southern US. The southern states constitute an expanding electrical market. Although this ocean thermal resource has a seasonal variation, the resulting OTEC power variation is well matched to the seasonal variation of the electrical load in that part of the country. Assuming the validity of present cost projections for OTEC energy, OTEC power plants will penetrate the baseload US electricity market. In particular, the first commercial OTEC plants can probably deliver energy at places such as Puerto Rico and Hawaii at costs less than those for oil-derived electricity at those locations. Thus, it is likely that islands will provide early OTEC markets. The market for OTEC-derived ammonia for use as fertilizer is expected to increase as OTEC costs diminish with increased production. Alternatives for producing ammonia are coal and natural gas.

51296 Introduction to Ocean Thermal Energy Conversion (OTEC) power plants. Pont, R.J. (Lockheed Missiles and Space Co., Sunnyvale, CA). pp 379-397 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

The history of the OTEC concept and the Department of Energy's present OTEC development program is reviewed briefly. Lockheed's OTEC plant concept will then be presented as an illustration of current thinking, and the basic economics of OTEC plants will be discussed. Finally, some technical and institutional problems affecting OTEC plants will be indicated, along with possible solutions.

SOLAR RADIATION UTILIZATION

REFER ALSO TO CITATION(S) 51216, 51217, 51218, 51224

SPACE HEATING AND COOLING

REFER ALSO TO CITATION(S) 51320, 51851

51297 (AD-A—060458) **Third interim technical report on USAFA solar test house design parameters. Report for May 1977—April 1978.** Eden, A.; Tinsley, J.T. (Civil and Environmental Engineering Development Office, Tyndall AFB, FL (USA). Detachment 1 (ADTC)). Sep 1978. 154p. Y A08/MF A01.

This report describes the continuing performance of the first retrofit-constructed, solar-heated facility in the USAF, the Solar Test House at the USAF Academy. Continued efforts to improve the performance have been a further reduction of the storage tank volume and installation of make-up water system to work in conjunction with the bleed air valves. The thermography studies started during the previous research period were completed and the techniques of using this advanced procedure for displaying flow patterns validated. The data analysis for the Solar Test House shows the improvement to the efficiency of the total system's ability to supply the thermal energy to the structure. Finally, the various parameters used to design the solar energy systems originally are analyzed and shown to be valid for this application.

51298 (DOE/CS/2522—1) **Survey of state legislative programs that include passive solar energy.** Weiss, S. (PRC Energy Analysis Co., McLean, VA (USA)). Jun 1979. Contract EG-77-C-01-2522. 138p. P 07/MF A01.

This report surveys and evaluates state-level solar-incentive programs, including passive solar energy. The range of programs examined focuses on financial and legal incentives designed to speed the implementation of solar heating, cooling, and hot water systems. They have been evaluated by probing the wording of the incentive legislation and by interviewing state program administrators in each state to determine: (1) the extent, if any, of passive inclusion in solar-incentive programs, and (2) the level of success that various implementation techniques have achieved for encouraging passive solar designs as opposed to the more-commonly-understood active systems. Because no states have initiated incentive legislation designed exclusively to encourage passive solar techniques, it has been essential to determine whether legislative programs explicitly or implicitly include passive solar or if they explicitly exclude it.

51299 (DOE/TIC—10160) **Solar house design competition.** (Illinois Committee for Energy and Architecture, Springfield (USA)). 1977. 58p. P 04/MF A01.

Competition winners are described and illustrated. The winners are pictured in the following categories: single family passive designs, single family active designs and multi-family active designs. (MHR)

51300 (EPRI-ER—1095-SR) **Solar heating and cooling research projects: a summary.** Lansing, N. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA)). May 1979. 30p. P 03/MF A01.

The major EPRI solar heating and cooling experimental projects are summarized. In addition to outlining each project and its purpose, the report describes the major features of the solar systems. Also included are relatively detailed descriptions of the performance-monitoring equipment. As additional technical performance results are obtained and new projects added to the program, this document will be updated to include the new information. These projects provide a basis for verification of analytic work aimed at determining the preferred solar system for any given utility service area, i.e., the system that provides the lowest total cost to the consumer and the utility.

51301 (SAN—1590-1/2) **Development of a high temperature solar powered water chiller. Volume II. Phase I technical progress report, September 26, 1977—June 1, 1978.** (Mechanical Technology, Inc., Latham, NY (USA)). 1 Jun 1978. Contract EG-77-C-03-1590. 139p. PC A07/MF A01.

The development of a Rankine cycle heat engine subsystem is presented. An analysis was conducted on the turbomachine subsystem, which included establishing the range and level of the turbomachine performance, generating the turbo package layout, and evaluating the subsystem cost. (MHR)

51302 Solar energy for residential housing. Martin, J.H. (Sheaffer and Roland, Inc., Chicago, IL). pp 105-122 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

An attempt is made to evaluate the feasibility of using energy conservation and solar energy harvesting to produce thermal comfort in residential housing. This choice is made because it appears to be more likely to be successful than other solar harvesting strategies such as generating of large quantities of electrical energy. The technical feasibility for conservation of energy and harvesting of solar energy for yielding residential comfort is assumed. Careful treatment is required of the economic feasibility. Because of the broad consequences of employing the necessary technical and economic strategies, the impact upon the quality of life and upon our institutions also must be treated carefully. The magnitude of the potential impact of these strategies upon the national energy budget can be estimated from the fact that about 15 percent of this budget is used for residential temperature control. About 70 million residential units are in existence at the present time. About 2 million new ones are being built each year. Clearly the strategies considered are easier to employ on new structures than on existing ones.

51303 Solar energy for residential housing. Martin, J.H. (Sheaffer and Roland, Inc., Chicago, IL). pp 105-122 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

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51304 Architecture of homeostasis. Wright, R. pp 157-181 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

The architecture of homeostasis is today's creative approach to shelter design, bringing an understanding of climate and of local climatic and geographic conditions to the design process. In this manner, the architect can reduce building demands for nonrenewable fossil fuels and, at the same time, maximize use of natural energy systems. This design approach is discussed in the context of Midwest conditions and examples are offered.

51305 Design of active solar heating systems. Duffie, J.A.; Beckman, W.A. (Univ. of Wisconsin, Madison). pp 183-208 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

Some of the solar heating systems which have been proposed and built; general methods for design of these systems using simula-

tions; design of system of standard configurations by "short-cut" design methods; and economic criteria and methods for evaluating solar energy systems are briefly described.

51306 Solar absorption cooling. Anderson, P. (Arkla Industries Inc., Evansville, IN). pp 209-222 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

This paper is concerned with absorption cooling systems only. A generalized diagram and discussion of an absorption unit are presented along with requirements for successful refrigerant-absorbent combinations. The pressure temperature concentration charts for both the water-lithium bromide and the aqua ammonia cycles are presented. Possible water cooled and air cooled cycles for each combination are considered. For use with a flat plate collector it is obvious that a water cooled unit must be used. Reasons for preferring the bromide unit are given. The operating cycle of a gas fired absorption unit is described. Modification of this unit for solar operation and resulting ratings are presented. A water fired small commercial unit with marginal solar application is described. Second generation residential and small commercial units employing mechanical rather than thermosyphon solution pumps and operating with lower temperature hot water are presented. Work on a third generation residential unit, employing direct evaporatively cooled absorber and condenser, is described along with objectives of the project. Another project involves development of a systems package which combines a number of elements including the absorption chiller in a single unit to simplify solar installations. Two such installations are described.

51307 Solar desiccant systems for heating and cooling. Rush, W.F. pp 223-239 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

A number of variations have beem proposed to achieve what has become known as "desiccant cooling". The basic concept, however, involves dehumidification of an air stream followed by removal of the heat of condensation and adsorption. Further cooling of the dehumidified air can be achieved by evaporation. The desiccant is regenerated by a heat source. Often, a significant amount of this thermal energy can be supplied by solar energy.

51308 Theory of solar assisted heat pumps. Granryd, E. (AGA Heating Div. AB, Stockholm, Sweden). pp 241-266 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

As introduction, a few reasons for combining solar energy systems with heat pump systems are given. A description is made of the performance and efficiency characteristics of commonly used heat pumps. The influence of different components and parameters of the heat pump system is reviewed. The philosophy of solar assisted heat pump systems is discussed by means of a simple example and basic schemes are given. Finally results from an analysis of the COP for heat pump installations in Scandinavia are given.

51309 Contribution to the technical review of solar heat pumps. Wurm, J.; Kouo, M.T. (Inst. of Gas Technology, Chicago, IL). pp 267-307 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

It is suggested that because conventional heat pumps use the energy from surrounding environments (waste heat excepted) in the heating mode as a source of heat they should be considered as solar heat pumps. In this context, the performance of these solar heat pumps can be improved by: (1) incorporating heat source storage and solar augmentation, (2) capacity-load matching, and (3) recovering rejected heat from driving engines. The first approach constitutes the bulk of present research activity, as shown in a survey of current solar heat pump applications. However, it is also demonstrated that similar improvements can be achieved by simpler methods such as capacity-load matching and recovering heat from driving engines.

51310 Solar application in the poultry industry. Reece, F.N. (Dept. of Agriculture, Mississippi State, MS). pp 347-358 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

The production of poultry requires a dependable source of energy for heating the structures for growing the chickens and turkeys. About 18.5 x 10^{12} Btu of energy is used annually to heat poultry houses, of which 80% is provided by liquified petroleum gas (LPG). A solar heating system has been designed and tested which has the potential for replacing about 90% of the LPG used when the system is used in conjunction with energy conservation techniques which have been shown to reduce fuel energy requirements by 70%.

51311 Boosting the performance of solar HVAC systems by improving component interactions. Newton, A.B. pp 359-370 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

The components which make up typical solar heating and cooling systems have different performance characteristics as to loads, ambient temperature, and heat rejection temperature variations. To optimize a system or its control strategy the relationships among the following items must be understood and properly interrelated over the entire load range, - building load pattern, component performance profiles, storage reactions, piping and ducting, air handler response, sink temperature, ambient range, collector performance map, control strategy, local insolation and cloud patterns, and system response. These items are the principal determinants of how well the solar heating or cooling function contributes to the building needs throughout the year. Over some the designer has no control, but he must understand them all. Proper meshing of all eleven items may make it possible to reduce the area of the solar collector array by 30 to 40% without reducing performance as compared to an unmeshed system. Yet most jobs so far examined recognize only 4 or 5 of these determinants. A visualization of the interactions of these factors, is presented and those items which seem to be least understood are concentrated on to show how they can be utilized more effectively to increase the economic feasibility of solar heating and cooling.

51312 Design and analysis of a North Dakota annual cycle residential solar heating system. Bulletin No. 77-04-EES-01. Somerville, M.H.; Mathsen, D.V.; Loken, G.R.; Svard, C.D.; Wendschlag, J.C. Grand Forks, ND; North Dakota University (1977). 25p. (NP—23803).

The design of an experimental residential solar heating system situated in North Dakota is discussed and described. The system described provides all of the energy required to heat and, under certain operational modes, air-condition the residence. The system presented is flexible; five different operational modes are examined for the system described. The results indicate that the annual cycle energy system operational mode may be most economic while reducing procured energy by 61%. The maximum energy conservation mode reduced the procured energy base by 72% but required over twice the capital investment of the annual cycle system.

51313 Economics of solar space heating and cooling. Bulletin No. 77-04-EES-04. Svard, C.D.; Somerville, M.H.; Mathsen, D.V. Grand Forks, ND; North Dakota University (1977). 16p. (NP—23806).

An economic analysis of a solar heated and cooled private home is developed. The basis of the analysis is an experimental solar home located at Larimore, North Dakota. This 214 m^2 (2,300 ft^2) home utilizes a solar assisted heat pump heating and cooling system with 97 m^2 (1,050 ft^2) of forced air solar collector and 15,140 to 151,400 liters (4,000 to 40,000 gallons) of water storage capability. This paper includes a comparative study of the costs inherent with this system with those of conventional systems (gas, fuel, and electric) for a similar sized house. Types of costs examined include those for the heating unit, fans, water storage area, evaporators, and pumps. Costs of conventional systems include the heating and cooling units, fans and systems layout. Operational costs of the same systems are simulated with the aid of a computer model of the experimental system.

AGRICULTURAL AND INDUSTRIAL PROCESS HEAT

REFER ALSO TO CITATION(S) 51310

51314 Evaluation model of solar industrial process heating. Ciliano, R.; Fallah, M.H.; Limaye, D.R. (Mathtech, Inc., Princeton, NJ). pp 639-664 of Symposium papers: energy modeling and net energy analysis. Chicago, IL; Institute of Gas Technology (1978).

From Conference on net energy analysis and energy modeling; Colorado Springs, CO, USA (21 Aug 1978).

This paper describes a recently completed study for a commercialization plan for solar industrial thermal process applications. The study focused upon fifteen 4-digit SIC groupings which collectively now consume 55% of all industrial process energy. The analytic framework consists of assessing a particular solar technology (9 alternatives)...for process applications within a particular temperature range (3 defined)...versus a given conventional competing fuel (3 considered)...in a plant of given size (3 relative capacities)...contained within a specific target market (15, 4-digit SIC groupings)...located within a specific geographic area (6 solar regions)...operating within an assumed work-shift mode (2 considered). Groups of individual incentives were then packaged to define feasible commercialization strategies that the government might

adopt so as to increase both the rate and absolute level of solar market penetration. For each alternative strategy, a time trajectory of market diffusion was estimated and a corresponding first-order benefit-cost ratio computer on the basis of projected fossil-fuel savings relative to altered government tax revenues. 26 references.

51315 Solar energy applied to grain drying. Shove, G.C. (Univ. of Illinois, Urbana). pp 337-345 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

Prior investigations explored the application of solar energy to a variety of grain drying methods; however, one of the most promising uses of solar drying appears to be applying it to low temperature corn drying. Low temperature drying is a method of reducing grain moisture content over an extended period of time with only small temperature rises of the drying air. Such a procedure utilizes solar energy over an extended period of time and allows fluctuations in the air conditions to be tolerated. Farm buildings have large areas of flat surfaces that can be converted to solar collectors with only minor modification in the design and construction of the buildings. Bare plate and covered plate collectors have been incorporated into the walls and roofs of machinery storage buildings, livestock shelters, and grain bins to collect solar energy for the drying of grain. The building collectors are efficient, even though various air cavities are utilized, because of the high airflows used in drying grain. In some situations the building collectors are also used to heat repair shops and to modify the temperature of ventilation air in livestock shelters. Therefore, the use of solar energy as a heat source for farmstead operations should be given consideration as existing facilities are remodeled or new facilities are planned.

WATER HEATING

REFER ALSO TO CITATION(S) 51297, 51300

51316 (EPRI-ER—1078) **Solar water heating and data monitoring systems at South County Hospital, Wakefield, Rhode Island. Final report.** Cummings, R.D.; Peck, D.J.; Hall, W.J. (Daystar Corp., Burlington, MA (USA)). Jun 1979. 43p. P 03/MF A01.

Daystar Corporation installed a solar/electric, domestic water heating system in the Borda Wing of the South County Hospital, Wakefield, Rhode Island, in 1975. THe primary purpose of this project was to study the feasibility of the use of Solar Energy in a commercial, healthcare institution. The thermal performance of this system was monitored from December 1976 through March 1978. The final stages of the development of the computerized monitoring system, and the system performance results for the 16 month monitoring period are described.

OTHER

51317 (SAN—1101/PA2-21) **Solar-powered irrigation systems. Technical progress report, July 1977—January 1978.** (Aerospace Corp., El Segundo, CA (USA). Energy and Transportation Div.). 28 Feb 1978. Contract EY-76-C-03-1101-002. 159p. (ATR—78(7693-01)-1). P 08/MF A01.

Dispersed solar thermal power systems applied to farm irrigation energy needs are analyzed. The 17 western states, containing 84% of nationwide irrigated croplands and consuming 93% of nationwide irrigation energy, have been selected to determine were solar irrigation systems can compete most favorably with conventional energy sources. Financial analysis of farms, according to size and ownership, was accomplished to permit realistic comparative analyses of system lifetime costs. Market potential of optimized systems has been estimated for the 17-state region for near-term (1985) and intermediate-term (2000) applications. Technical, economic, and institutional factors bearing on penetration and capture of this market are being identified.

SOLAR COLLECTORS AND CONCENTRATORS

REFER ALSO TO CITATION(S) 51254, 51900

51318 (COO—4577-8) **Evaluation of combined photovoltaic/thermal collectors.** Hendrie, S.D. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1979. Contract EG-77-S-02-4577. 5p. (CONF-790541—54). P 02/MF A01.

From International Solar Energy Society meeting; Atlanta, GA, USA (28 May 1979).

The thermal and electric performance of an air and a liquid type combined photovoltaic/thermal solar collector has been evaluated, yielding close correlation with theoretical results. Maximum thermal efficiencies of 42.5% and 40% for the liquid and air collectors without electric power production decreased to 40.4% and 32.9% when electrical power was produced. Maximum electrical efficiencies of 6.8% were measured.

51319 (NBSIR—78-1535) **Laboratories technically qualified to test solar collectors in accordance with ASHRAE Standard 93-77: summary report.** Niessing, W.J. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Nov 1978. Contract EA-77-A-01-6010. 38p. P 03/MF A01.

In fulfilling its responsibilities under the National Program for Solar Heating and Cooling of Buildings established as a result of the Solar Heating and Cooling Demonstration Act of 1974 (PL 93-409) and related legislation, the Energy Research and Development Administration (ERDA) requested the National Bureau of Standards (NBS) to develop criteria for assessing the capabilities of laboratories for testing solar collectors, to identify those laboratories qualified to test solar collectors, and to develop a plan for the certification of solar collectors. NBS engaged the professional services of ARI Foundation, Inc. (ARIF), a subsidiary of the Air-Conditioning and Refrigeration Institute (ARI), to identify laboratories qualified to test solar collectors and to develop documentation for a solar collector certification program. The identification of qualified solar collector testing laboratories is reported. The procedures used by ARIF and the results of their evaluation are discussed, and the laboratories evaluated as qualified to test solar collectors in accordance with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 93-77 are listed. Continuing activities for laboratory accreditation are identified.

51320 (NP—23859) **Interrelations between solar systems and buildings in the integration of solar collectors on roofs and walls.** Hullmann, H. (Hannover Univ. (Germany, F.R.)). 1977. 213p. (In German). U 10/MF A01.

Thesis.

There are close interrelations between solar systems and buildings if the collectors are installed on the buildings or integrated in these. These interactions are investigated from a functional as well as from a technical point of view. Investigations deal with (1) functioning and design of solar collectors, (2) requirements for the arrangement of solar collectors, (3) constructional physics problems with flat and inclined roofs, (4) constructional physics problems in walls, (5) compatibility problems. There is an appendix discussing problems of the interrelation between solar energy utilization and population density and the relation between the design and functioning of solar houses.

51321 (NTIS/PS—78/1341) **Optical coatings for solar cells and solar collectors (citations from the NTIS data base). Report for 1964—October 1978.** Carrigan, B. (National Technical Information Service, Springfield, VA (USA)). Dec 1978. 248p. Y N01/MF N01.

Materials and research for the development of selective coatings for solar energy conversion devices are described in these citations. These materials include types of coatings or covers used to reflect or transmit solar radiation in order to optimize solar conversion to heat or electricity. Most studies concern antireflection, thermal control, or reflective coatings. Coatings which act as optical filters are also covered. (This updated bibliography contains 241 abstracts, 41 of which are new entries to the previous edition.)

51322 (NTIS/PS—78/1342) **Optical coatings for solar cells and solar collectors (citations from the Engineering Index data base). Report for 1970—December 1978.** Carrigan, B. (National Technical Information Service, Springfield, VA (USA)). Dec 1978. 175p. Y N01/MF N01.

This bibliography of worldwide journal literature cites reports on materials and research for the development of selective coatings for solar energy conversion devices. These materials include types of coatings or covers used to reflect or transmit solar radiation in order to optimize solar conversion to heat or electricity. Most studies concern anti-reflection, thermal control, or reflective coatings. Coatings which act as optical filters are also covered. (Contains 169 abstracts)

51323 (SAND—78-7022) **Linear concentrating solar collector in an air-supported enclosure preliminary design study. Final report.** Laakso, J.H.; Zimmerman, D.K. (Boeing Engineering and Construction Co., Seattle, WA (USA)). Mar 1979. Contract EY-76-C-04-0789. 93p. P 05/MF A01.

A preliminary design for a low-cost linear parabolic concentrating solar collector in a pneumatically stabilized cylindrical plastic film enclosure and analyses of its theoretical performance and projected costs are described. Potential applications for the concentrator are in heating fluids to the mid-temperature range for use in industrial process heating. The study objective was to develop an inovative design concept having pneumatically stabilized plastic film enclosure as an approach to achieving low collector cost. Both circular film and rigid parabolic reflector concepts were investigated; the concept fulfulling the study objective has a lightweight aluminum honeycomb sandwich parabolic trough reflector with an aluminized polyester film reflective surface. The reflector panels and

a block-chrome plated carbon steel absorber tube are supported at intervals by rings with spokes. Cylindrical film enclosure sections are attached to the rings which are supported by rollers; this assembly rotates about the fixed absorber tube and is driven by an electric gearmotor and microprocessor-based control system. Key design features for a collector with a weatherized polyester enclosure 2.8 m diameter by 30.5 m long (9.33 by 100 ft.) and an aperture area of 69.3m² (745.9 ft²) are given. For this collector configuration, structural analyses, thermal performance modeling, mass-produced component costs, field assembly methods and maintenance requirements are discussed. Daily efficiencies in excess of 45% are predicted with estimated installed field collector costs of $90/m² ($8.34/ft²). Results of cost and performance studies indicate that the collector has potential for low cost and offers attractive cost/performance figures-of-merit with further development.

51324 (SAND—79-0514) **Performance testing of the General Electric Engineering Prototype Collector.** Dudley, V.E.; Workhoven, R.M. (Sandia Labs., Albuquerque, NM (USA)). Jul 1979. Contract EY-76-C-04-0789. 35p. P 03/MF A01.

Results of tests on the General Electric Engineering Prototype Collector, a 5-meter parabolic dish solar concentrator, are provided. This collector is a first prototype for a solar total energy system proposed for a knitwear plant in Shenandoah, Georgia.

51325 (STUDSVIK/E—3-78/19) **Description of a test station for the outdoor testing of water-cooled solar collectors of Studsvik, Sweden.** Farvolden, S.; Zinko, H.; Eriksson, L. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 26 Oct 1978. 26p. (In Swedish). U 03/MF A01.

A test station for the outdoor testing of water-cooled solar collectors is described. An outline diagram of the station is given as well as short descriptions of its different components. The standards for tests of solar collectors proposed in USA have been followed and the station will also follow the future Swedish requirments on test stations for solar collectors. In the last part of the report the measuring method is described together with the principles for presentation of test results from the station.

51326 Solar energy collector and concentrator. Meinel, A.B.; Meinel, W.B. (to Motorola, Inc.). US Patent 4,131,485. 26 Dec 1978. Filed date 6 Mar 1978. 14p.

Modular structures for the collection, concentration and conversion of solar energy to another usable form such as electrical energy are described. The structures feature three conic section reflective surfaces, two of which focus in front of a receiver element and off the axis of the structure. The third relative surface is utilized to redirect that energy which would otherwise miss the receiver element to improve overall efficiency.

51327 Solar energy and the flat plate collector: an annotated bibliography. de Winter, F. (Atlas Corp., Santa Clara, CA). pp 19-52 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

The literature on the flat plate collector covers a number of decades and involves many journals and books. To date there seems to be no single source in which the significance of the literature is discussed in some detail. This annotated bibliography constitutes an attempt to do this for the flat plate collector itself, and for the solar input quantities which must be used for performance calculations. The possible uses of the flat plate collector are not discussed in detail.

51328 Practical considerations for capturing the sun. Buckley, N.A. (Chamberlain Mfg. Corp., Waterloo, IA). pp 53-67 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

The installation of solar collector systems for conversion of solar energy to thermal energy is progressing from the experimental, or demonstration, stage to the age of practical application. Many of these practical answers are the result of experience. This paper reviews some basic problems that face the installer, such as: the logical solar array location, solar array support structure design, array piping and piping insulation, and on-site handling of collector panels. Solutions that have been applied to these problems are illustrated and reviewed.

51329 Long-term average performance of the Sunpak evacuated-tube collector. Mather, G.R. Jr.; Beekley, D.C. (Owens-Illinois, Inc., Toledo, OH). pp 69-84 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

Incidence-angle effects are considered for the Owens-Illinois Sunpak evacuated-tube collector. These effects are described in terms of an incidence-angle modifier, which is evaluated for diffuse, cylindrical, involute, and V-trough reflector geometries. It is shown that the daily-average slope-intercept characteristic, upon which long-term performance estimates should be based, is related in a simple way to the average daily incidence-angle modifier, and that this average characteristic can differ significantly from the solar-noon slope-intercept characteristic. In particular, the daily-average intercepts for the diffuse and involute reflectors are 8% higher than the solar noon intercepts, whereas the daily-average intercept for the V-trough reflector is 17% lower than the solar-noon intercept. In the case of the cylindrical reflector, the daily-average intercept is only 2% lower than the solar noon value. The importance of considering incidence-angle effects in long-term performance estimates is illustrated by applying the f-chart and anti PHI, f-chart methods to hypothetical domestic hot water and space conditioning loads in the Boston and Washington, DC areas. It is shown that use of the solar-noon slope-intercept characteristic can result in errors in excess of 20% in estimated energy output.

51330 Tracking high temperature collectors. Eldredge, L.L. (Northrup, Inc., Hutchins, TX). pp 97-104 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

Solar air conditioning, heating and process heat applications are often most cost effective when a tracking, concentrating solar collector is used. High efficiencies at high temperatures, combined with daylong exposure to direct normal radiation, typically allow the concentrator to collect twice as many Btu's per square foot as a non-concentrating flat plate collector. And because prismatic lenses and other components can be mass produced, the economic aspects of using concentrators are frequently very attractive. The heliostat/central receiver concentrator and parabolic reflector devices are discussed, and attention is centered on the tracking Fresnel lens solar collector. A sun-activated tracking mechanism is described, and the world's largest solar heating and air conditioning project at Trinity University is discussed with emphasis on the utility savings that have been realized in the first several months of operation.

51331 Flat-plate solar collector using non-black absorber elements. Bulletin No. 77-04-EES-02. Mathsen, D.V.; Somerville, M.H.; Loken, G.R. Grand Forks, ND; North Dakota University (1977). 16p. (NP—23805).

A low-cost, low-maintenance collector requiring no specialized fabrication processes was desired for incorporation into a solar house built near Larimore, North Dakota. The long-wave emissivity, ϵ, and the visible-range absorptivity, α, of commercial galvanized sheet are selective in nature ($\epsilon = .23$, $\alpha = .66$). The effective absorptivity of galvanized steel was further increased by the creation of parallelogram cavities. A prototype collector was constructed and efficiencies determined for a narrow range of the parameter, (T/sub coll/-T/sub amb/)/I, where T/sub coll/-T/sub amb/ is the temperature differential across the face of the collector and I is the incoming solar energy. The experimental data, together with the results of a computer simulation program indicate a collector design competitive with commercially available designs using expensive coatings or paints with questionable life expectancies.

HEAT STORAGE

51332 (SAND—79-8634) **High temperature compatibility of nitrate salts, granite rock and pelletized iron ore.** Burolla, V.P.; Bartel, J.J. (Sandia Labs., Albuquerque, NM (USA)). Aug 1979. Contract EY-76-C-04-0789. 32p. P 03/MF A01.

Under the direction of the Department of Energy, high-temperature (550°C) thermal energy storage concepts are being studied for application with second-generation solar central receiver thermal power systems. The report evaluates the compatibility of the current choice of working fluids with common granite rock and a pelletized iron ore. Results indicate that the long-term stability of iron-ore pellets in binary mixtures of potassium and sodium nitrates is superior to granite rock-salt mixtures and salt systems without solid media. Corrosion of the Inconel 600 vessels was observed.

GEOTHERMAL ENERGY

51333 International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). 1009p. (In several languages). (CONF-761058—). $30.00.

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

Separate abstracts were prepared for each paper. One paper appeared previously. (MHR)

51334 Programs of education and training. Guerra Hernandez, C.F. (Instituto Italo-Latino Americano, Rome, Italy). pp 853-858 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

With few exceptions the countries of Latin America do not have a coherent and constant policy of scientific and technological development. The initiatives which have been taken in developing educational and training programs to educate scientific and technical personnel in the discovery and exploitation of geothermal energy are briefly summarized. The establishement of a Central America School of Geology in 1973 and a course on Energy Economics sponsored by the Bariloche Fundacion in Argentina are cited as two examples of educational programs which should be expanded. (JSR)

RESOURCE STATUS AND ASSESSMENT

USA

51335 (ORO—5443-1) **Operation research and systems analysis of geothermal/geopressured resources in Texas. Final report.** Zinn, C.D. (Texas Univ., Austin (USA). Center for Energy Studies). Dec 1977. Contract EG-77-S-05-5443. 88p. P 05/MF A01.

Preliminary geothermal/geopressured energy development scenarios for the state of Texas were prepared and analyzed. The overall objective of these projects is the formulation of a coordinated regional plan for the development of the geothermal/geopressured energy resources in the Texas/Louisiana region. Work accomplished, plans for the continuation of this planning support effort, and general conclusions and recommendations are included. Appendices contain additional detailed information related to the development scenarios. (MHR)

NON-USA

REFER ALSO TO CITATION(S) 51381

51336 Geothermal energy as an alternative source for the generation of electric energy in Colombia. Dominguez Reyna, H. (Instituto Colombiano de Energia Electrica, Bogota, Colombia). pp 721-724 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

Electric power in Colombia is generated primarily by hydroelectric power, with 69.6% of the installed capacity. It is projected that the installed hydroelectric capacity will be 83.5% of the total in 1985. However there are potential geothermal resources; preliminary plans are being formulated for their investigation and evaluation. (JSR)

51337 Regional planning in geothermal energy. Arosemena, R. (CEPAL, Mexico City, Mexico). pp 861-886 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

Under the auspices of the Program of the United Nations for Development, a program for the development of the goethermal resources in Central America was initiated. After a brief description of the national activities in this area and a justification for such a program, the objectives of the program are outlined. The work plan is given and a time schedule is tabulated. (JSR)

51338 Central American geothermal enterprise. Del Valle V., A. (PNUD, New York, NY). pp 917-934 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The countries of the Central American isthmus have planned the task of developing their geothermal resources in the next decade with an investment which will exceed 200 million US dollars in order to install a generating capacity of the order of 450 MW. This endeavor will require a vast mobilization of human, technical, and financial resources, international cooperation, and commercial capacity. The creation of a united enterprise for geothermal services, created for the electrical needs of the countries, appears a possibility to put this program into operation. This work will analyze primarily the energy context of the Isthmus and the present status of geothermal development, presenting some economic parameters. A general description is given of the enterprise and an evaluation of the social endeavor which it will require. Three possible institutional alternatives are then described with the reasons that make the united enterprise of geothermal services the most attractive. A general description is then given of this proposed enterprise: objective, constitution, fields of activity, financing, and tentative organization scheme. A development program is proposed and the reference terms are given for a study of the technical, economic, and institutional feasibility.

51339 Geothermal perspectives in Central America. Einarsson, S.S. (United Nations, New York, NY). pp 935-939 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The joint geothermal exploration of the Government of El Salvador and the United Nations, completed in 1971, achieved its objectives and led to the construction of a 60 MW power station at Ahuachapan, which now supplies about 40% of the electric energy of the country. Spurred by this example and the petroleum crisis all the Central American countries are now exploring geothermal resources with a view to eliminating petroleum imports, and a 450 MW geothermal power is planned in the region by 1985. The total geothermal potential is still unknown, but about 30 to 40 geothermal fields are known in the area. It is likely that geothermal power can supply a comparable amount of electric energy as the hydro power which has been estimated at 18,000 MW, and that those two resources could then supply the electric energy needs beyond the year 2000. The need for training of national personnel in geothermal techniques is emphasized.

51340 Possibilities of developing geothermal energy in Chile. Estay Martinez, H. (Departmento de Energia y Mineria, CORFO, Santiago, Chile). pp 941-955 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The endeavors to develop the geothermal resources of Chile, up to the present, have been centered in the extreme north of the country at Tarapaca and Antofagasta. In actuality the energy needs for industry and mining have been supplied by conventional thermal power plants operating with imported petroleum. The geothermal investigations were initiated in 1968 by making an inventory of the areas with hydrothermal activity. The most attractive areas for development could thus be selected. All these areas are located in the Alta Cordillera at a mean altitude of 4200 m above sea level, along the border of recent volcanism. The results of these investigations, which cover a large part of the regions of Tarapaca and Antofagasta, give an estimated power of the order of 400 MW for this zone; there is already a vapor-operated 25 MW geothermal power plant at El Tatio and the Puchuldiza is under development with one well already drilled and another in preparation. The government of Chile is soliciting foreign technical and financial aid to install the first geothermal electric unit at El Tatio as soon as possible.

51341 Concrete possibilities of developing regional programs for the exploitation of geothermal energy in Central America. Morales Acena, E.F. pp 965-969 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The actual perspectives of developing programs for exploiting in a united manner the geothermal resources of the region appears to be most limited in Central America. The panorama would offer some possibilities of development. The present work attempts to establish a methodology for the analysis of such possibilites. Its principal conclusion, however, is that a strong and decided support by the central governments is necessary before such a project can be a reality, especially if the National Electrification Institutes decide to initiate a duty-free endeavor in this area.

GEOLOGY, HYDROLOGY, AND GEOTHERMAL SYSTEMS

REFER ALSO TO CITATION(S) 51407

51342 (LBL—9464) **Basic theory and equations used in the two-phase multidimensional geothermal reservoir simulator, SHAFT79.** Pruess, K.; Schroeder, R.C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1979. Contract W-7405-ENG-48. 5p. (CONF-790906—14). P 02/MF A01.

From Geothermal Resources Council annual meeting; Reno, NV, USA (24 Sep 1979).

The algorithm of SHAFT79 is based on mass and energy balance equations for two-phase flow in a porous medium. These basic equations are formulated as Integrated Finite Difference equations. The latter formulation allows both regular and irregular dis-

crete grid approximations of reservoir geometry. The present version of SHAFT79 solves the non-linear mass and energy equations simultaneously using an efficient linear algebra package. The computer program is being applied to a vareity of problems to study both real reservoir behavior and to better understand the physics of two-phase systems. The types of applications include idealized one- and two-phase reservoir depletion, two-phase reservoir behavior with distributed liquid, simulation of real reservoirs, matching production data, and estimating material parameters from well test data.

USA

REFER ALSO TO CITATION(S) 51394

NON-USA

REFER ALSO TO CITATION(S) 51350

51343 Distribution of the geothermal anomaly in the Tosco-Laziale pre-Apennines zone. Calamai, A. (ENEL, Pisa, Italy); Cataldi, R.; Locardi, E.; Praturlon, A. pp 189-229 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Italian)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The method of geothermal exploration by the direct measurement of anomalies of temperature gradient or heat flux has been applied in Italy beginning in 1959—1960. After a descriptive review of the development of the method, the geologic status and hydrogeological conditions of the zone in which the method was applied re summarized. The results of the thermal measurements in the pre-Apennines zone, which extends from Pisa to Rome, are summarized. These results are discussed in the framework of data correlating the thermalism, tectonics, and magmatism of the region. On the basis of inspections made in deep perforated wells as well as indications obtained with the geothermal exploration, the significance and reliability of this type of exploration in the individualization of geothermal fields are emphasized. A synthesis of the methodology followed is given in an appendix.

51344 Relations between the structural order and geothermal manifestations in the non-volcanic area of Southern Italy. D'Argenio, B. (Universita degli Studi, Naples, Italy). pp 232-250 of International symposium on geothermal energy in Latin America. Rome Italy; Instituto Italo-Latinoamericano (1977). (In Italian)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

Southern Italy, between the meridian of Rome and Sicily, is a feature of the Alpine orogeny sharply curved in correspondence to the Calabrian arc, characterized by a wide development of tectonics with recovered strata and formed of segments alternatively in axial culmination and depression. Geothermal manifestations are present in such discontinuities along all the southern Apennines through western Sicily, outside of the peri-Tyrrhenian volcanic zone. Three groups of characteristic geologic elements in some areas with geothermal manifestations are analyzed. These are: (a) gross lithology and geometry of various geologic bodies, before and after deformation and their tectonic relations; (b) longitudinal structural order of the chain (depressions, axial culminations, or intermediate order); (c) actual evolution moment of the neotectonic process (uplift/erosion).

51345 Present status of geothermal investigations in the eastern zone of El Salvador. Retana, M.E.; Martinez Maltez, A. (Comision Ejecutiva Hidroelectrica de Rio Lempa, Soyapango, El Salvador). pp 273-313 of International symposium on geothermal energy in Latin America. Rome Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The geothermal investigations of the eastern zone of El Salvador integrate the Berlin, Chinameca, and San Vicente fields. The geothermal activity present in the zone is developed within the Fosa Central geotectonic unit, whose basement and lateral walls consist of volcanic rocks of Tertiary age. The geothermal systems of the region are connected genetically to a volcanism of Pleistocene age whose effusions occupy a large part of the Fosa. Hydrogeologic and geochemical investigations show the existence of shallow, semi-deep, and deep aquifers. The deep aquifer systems of high temperature and pressure are the prime object of the present studies. These have been detected in the area of the Tronador-1 well, Lempa-1 well, and Obrajuelo ausoles. There is the possibility that the aquifer existing between the last two sites pertains to an independent geothermal system. The results from the investigations of San Vincente and Chinameca are under evaluation.

51346 Study of water levels in Larderello region geothermal wells for reconstruction of reservoir pressure trend. Celati, R. (CNR, Pisa, Italy); Squarci, P.; Taffi, L.; Stefani, G.C. pp 501-526 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The study of the water levels measured during drilling in Larderello geothermal region (Larderello and Travale fields) has led to: the evaluation of reservoir steam pressures in the period preceding the systematic shut-in of the wells; the reconstruction of the piezometric surface or water-table of the aquifers surrounding the field and the pressure trend on the inside of some exploited areas; and an understanding of some aspects of the interactions taking place between vapour-dominated systems and neighbouring aquifers.

GEOTHERMAL EXPLORATION AND EXPLORATION TECHNOLOGY

REFER ALSO TO CITATION(S) 51405

51347 Evaluation of the geothermal potential: resources and reserves. Cataldi, R. (ENEL, Pisa, Italy). pp 77-109 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The estimation of the geothermal energy is the process of evaluation of the terrestrial heat in terms of resources, reserves, and of the distinct possible uses of the exploitable energy. After a discussion of some examples of evaluation appearing in the literature, the evolution of the production of geothermal energy up to 1975 is discussed. Such production constitutes a very small fraction (10^{-8} to 10^{-9}) of the potential geothermal resources to 10 km of depth. If we refer to the geothermal reserves available within the 3 km limit of the earth's crust, we can estimate that the geothermal energy which can be produced and exploited today in the world for power generation is 100 to 1000 times greater than that extracted and used for the same purposes up to 1975. The various classes of resources and reserves are defined and discussed and a synthesis is given of the evaluation methods adopted up to the present. The most important results of an evaluation defined the best Italian zone. On the basis of such results it is possible to present an example which emphasizes the quantitative differences between resources, reserves, and the various classes of reserves. A brief synthesis is given of the present trends in the development of geothermal energy.

51348 Models of industrial geothermal fields. Facca, G. pp 111-124 of International symposium on geothermal energy in Latin American. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Italian)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

In industrial exploration for geothermal energy, the general concept is that of the geothermal province. This concept is analogous, and highly important, to the theory of sedimentary basins in petroleum exploration. In the different geothermal provinces, and in every single province, geothermal fields with very different characteristics can exist. The various field models possible are examined: fields with a sedimentary cap rock (Larderello type), fields with a self-sealing cap rock, fields without cap rock, and the possible fields of impermeable hot rocks, exploited by the introduction of cold water into the artificially fractured hot rocks.

51349 Planned investigation of a geothermal field. Bethancourt, H.R. (Instituto Nacional de Electrificacion, Guatemala City). pp 153-175 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

A brief description is given of a systematic investigation of a geothermal field. The factors to be taken into consideration in evaluation of the field are delimitation of the area under investigation, infrastructure of the investigation, additional exploratory measures recommended, and the execution program. The work program at the Moyuta geothermal field is given as an example. (JSR)

51350 Exploration of the geothermal area of Moyuta. Bethancourt, H.R. (Instituto Nacional de Electrificacion, Ciudad de Guatemala); Dominco, E.; Girelli, M.; Pasquare, G. pp 177-188 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The systematic exploration of the geothermal area of Moyuta began at the end of 1975. After a detailed regional geologic and volcanologic study, gravimetric projection, geoelectric exploration with the Schlumberger and dipole—dipole methods, and gradient

measurement, the first exploratory well was drilled. The results confirmed the validity of the supposed hydrothermal system but showed the existence of extensive regions of impermeability of the reservoir formation which has impeded the accumulation of hydrothermal fluids in the perforated zone and which will make the future exploration more difficult.

51351 Electric method of geophysical exploration for the investigation of geothermal fields of the Central America area: electric sweep. Afonso, P.S. (Instituto Costarricense Electricidad, San Jose, Costa Rica). pp 315-322 of International symposium on geothermal energy in Latin America. Rome Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The errors that can occur in most electric survey methods because of the physical state of the water, degree of salinity, and depth, are summarized. The characteristics of an electric sweep system, which will avoid these errors and which is easier to install, are illustrated graphically. (JSR)

GEOPHYSICAL TECHNIQUES AND SURVEYS

51352 Chinetsukaihatsu kisochosa hokoku sho (No. 11). Sono 2. Juryoku tansa, denki tansa, bishojishin tansa. (Exploratory geothermal basic investigation for Amagase (No. 11). Part 2. Gravimetric prospecting, electrical prospecting, and microearthquake survey). Tokyo, Japan; Japan Geothermal Energy Development Center (1978). 80p. (NP—23849). Geological Literature Center, Tokyo, Japan 50 yen per sheet.

Gravimetric prospecting, electrical prospecting, and a microearthquake survey were conducted in the Amagase area where the Amagase, Yunotsuri, and Amagasetsuetate hot springs are located. The area is in the northern part of the volcanic, mountainous Kyushu district. An E—W gravimetric distribution which is thought to reflect the Matsuyama—Imari tectonic line was obtained in an area passing the Amagases hot springs and close to the Kusu River. An N—S tectonic line was observed from the southern part of Hida to the Oyama River. The Akaishi and Deguchi areas which are not considered to be geothermal field do not seem to be related to the above-mentioned tectonic lines but may be related to faults which intersect these lines. The low Bouguer anomaly running SE to NW coincides with the NW—SE gravimetric line observed in and around Wakifuta-yama. 21 figures, 8 tables.

51353 Seismic survey in Larderello: first results. Bernardi, A. (Compagnia Mediterranea Prospezioni, Rome, Italy; Cameli, G.M.; Romanini, E.; Squarci, P.; Stefani, G. pp 127-151 of International symposium on geothermal energy in Latin American. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

A seismic survey in Larderello (Italy) zone, including seismic and sonic logs and reflecting profiles, revealed the existence of reflecting events to several kilometers depth. On the basis of regional geological information and drilling data of deep wells, the hypothesis is discussed that, in Larderello zone, for stratigraphic or tectonic reasons there are competent and fractured horizons below the present exploited depth that could form a potential reservoir.

51354 Case history of Momotombo geothermal field. Girelli, M. (Electroconsult, Milan, Italy); Saltuklaroglu, M.; Vega, R. pp 251-271 of International symposium on geothermal energy in Latin America. Rome Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

A summary of investigations carried out during the exploration phase is made and the results obtained are compared with those of drilling and measurement data. The wells drilled up to now have shown that there is a cool water zone, as partly indicated by the geoelectrical work, just below the productionzone. The characteristics of the wells also indicate that there is a possibility of gradual cooling of the wells, or of the fluid produced from the shallow reservoir. However, it seems that the cooling effet may be limited to some wells and is controllable. Therefore, it is concluded that the field can be developed with reasonable confidence if the conditions of equilibrium between these two zones are maintained. This would require a comprehensive and careful field management.

GEOCHEMICAL TECHNIQUES AND SURVEYS

REFER ALSO TO CITATION(S) 51407

51355 Geochemistry in prospecting a geothermal field. Ellis, J. (Dept. of Scientific and Industrial Research, Petone, New Zealand). pp 23-27 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

Information needed on a new geothermal field and the sources of that information are listed. Geochemistry as a source of information is reviewed.

EXPLORATORY DRILLING AND WELL LOGGING

51356 (LBL—9462) **Review of LBL geothermal well testing equipment.** Haney, J.; Goranson, C.; Solbau, R.; Schroeder, R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1979. Contract W-7405-ENG-48. 4p. (CONF-790906—11). P 02/MF A01.

From Geothermal Resources Council annual meeting; Reno, NV, USA (24 Sep 1979).

The high temperatures and hostile environments of geothermal reservoirs have prevented the use of high precision downhole well testing instrumentation. For the measurement of temperature, pressure, and flow at temperatures in excess of 150°C, reservoir engineers have had to rely on less accurate non-electrical instrumentation. Sandia's development of high temperature electronics and the introduction of high temperature cable has now increased the temperature range of certain instruments utilizing downhole active electronics to 275°C. However, this instrumentation is not yet commercially available. Development of high temperature instrumentation with moderate accuracy utilizing passive electronics downhole has only been limited by the non-availability of high temperature multi-conductor cable. With the recent introduction of 275°C multiconductor cable, the simultaneous measurement of moderate to high precision temperature, pressure, and flow is possible this year. The accurate measurement of two-phase flow at the surface will also soon be technically possible. The involvement of the LBL Geothermal Reservoir Engineering Group in the development and evaluation of geothermal well testing instrumentation is presented.

51357 (NVO—1558-4(Vol.1)) **Atlantic coastal plain geothermal test holes, Virginia: hole completion reports.** Cobb, L.B.; Radford, L.; Glascock, M. (Gruy Federal, Inc., Houston, TX (USA)). Mar 1979. Contract ET-78-C-08-1558. 110p. P 06/MF A01.

A description of the Atlantic Coastal Plain Geothermal Drilling Program and data for the following geothermal test holes drilled in Virginia are summarized in this report: NASA/Wallops Island, Isle of Wight, Suffolk, Oceana naval Air Station, and Cheriton.

51358 (NVO—1558-4(Vol.2)) **Atlantic coastal plain geothermal test holes, Virginia: hole completion reports.** Cobb, L.B.; Radford, L.; Glascock, M. (Gruy Federal, Inc., Houston, TX (USA)). Mar 1979. Contract ET-78-C-08-1558. 114p. P 06/MF A01.

A description of the Atlantic Coastal Plain Geothermal Drilling Program and data for the following geothermal test holes drilled in Virginia are summarized: Creeds, Norfolk Naval Base, Langley Air Force Base, Wattsville, Withams, and Atlantic.

51359 (NVO—1558-4(Vol.3)) **Atlantic coastal plain geothermal test holes, Virginia: hole completion reports.** Cobb, L.B.; Radford, L.; Glascock, M. (Gruy Federal, Inc., Houston, TX (USA)). Mar 1979. Contract ET-78-C-08-1558. 96p. P 05/MF A01.

A description of the Atlantic Coastal Plain Geothermal Drilling program and data for the following geothermal test holes drilled in Virginia are summarized: Accomac, Eastville, Hampton, Smith Point, and Suffolk.

51360 Geothermal drilling in El Salvador. Jimenez Arevalo, M.; Campos Villafuerte, T.A. (Comision Ejecutiva Hidroelectrica del Rio Lempa, Soyapango, El Salvador). pp 461-499 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

A general description is given of how the geothermal investigations are carried out in El Salvador by means of superficial and deep drilling. The steps up to the production phase, which has now been reached, are outlined. The most important technical problems to be solved in exploiting the different types of drillings made are summarized.

51361 (UCRL—15032) **Assessment of non-destructive testing of well casing,, cement and cement bond in high temperature wells.** Knutson,, C.K.; Boardman, C.R. (GeoEnergy Corp., Las Vegas, NV (USA)). [nd]. Contract W-7405-ENG-48. 215p. P 10/MF A01.

Because of the difficulty in bringing geothermal well blowouts under control, any indication of a casing/cement problem should be expeditiously evaluated and solved. There are currently no high temperature cement bond and casing integrity logging systems for geothermal wells with maximum temperatures in excess of 500°F. The market is currently insufficient to warrannt the private investment necessary to develop tools and cables capable of withstanding high temperatures. It is concluded that a DOE-funded development program is required to assure that diagnostic tools are

available in the interim until geothermal resource development activities are of sufficient magnitude to support developmental work on high temperature casing/cement logging capabilities by industry. This program should be similar to and complement the current DOE program for development of reservoir evaluation logging capabilities for hot wells. The appendices contain annotated bibliographies on the following: high temperature logging in general, cement integrity testing, cosing integrity testing, casing and cement failures, and special and protective treatment techniques. Also included are composite listing of references in alphabetical order by senior author.

LEGAL AND INSTITUTIONAL ASPECTS

51362 Federal geothermal program of the United States. Blake, F.G. (ERDA, Washington, DC). pp 891-894 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The US Geothermal Program is reviewed briefly. The strategy for stimulating the industrial development of geothermal energy is mentioned. The agencies responsible for geothermal exploration are listed. (MHR)

ECONOMIC AND FINANCIAL ASPECTS

51363 Principles and economics of multipurpose geothermal development. Barnea, J. (United Nations Inst. for Training and Research, New York, NY). pp 385-390 of International symposium on geothermal energy in Latin America. Rome Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The paper calls for a broad definition of geothermal resources, argues that multipurpose utilization allows higher efficiency in energy utilization and minimizes environmental problems. Multipurpose development depends on the resource condition and the local economic conditions. The multipurpose geothermal planner has to possess a detailed knowledge of the geothermal resource characteristics and full information on the temperature and other requirements of the many uses of geothermal resources for agricultural, industrial forestry and other uses. On the basis of these data, feasibility studies will be required to determine the best economic multipurpose project. Finally, the paper mentions a number of multipurpose possibilities in Latin America.

51364 Geothermal energy: economic aspects. Leardini, T. (ENEL, Rome, Italy). pp 825-836 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Italian)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The principal components in the cost of geothermal energy are analyzed. These include evaluation of the mining costs in finding and extracting endogenous fluids in optimum quantity, evaluation of the costs relative to the construction of the various plant components, and evaluation of the operational costs. From the evaluation of the three cost components and from the financial conditions prevalent in the country where the endogenous source is found, it is possible to obtain with well-known calculation methods the cost of the energy produced. Such methods are described briefly. The most important of the recent studies on geothermal economics are cited as a source of further detailed information.

51365 Technical, economic, and social aspects of geothermal energy. Bisogno, P. (CNR, Rome, Italy); Ippolito, F. pp 837-851 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The economic evaluation of geothermal energy is analyzed with respect to the availability of the resource, the utility of the resource, and a cost benefit analysis with respect to other alternative sources. The cost benefit analysis is applied to the particular case of Italy. The utilization of low enthalpy fluids is briefly considered. The technological aspects are discussed with respect to hydrothermal systems, geopressured systems, and hot dry rock systems. Environmental aspects are briefly considered in conclusion. (JSR)

51366 Economic feasibility of geothermal plants: involuted economic risks. Baldo, L. (ELC, Milan, Italy). pp 887-890 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

In addition to the exploration risks, which must be considered as a probable net loss, a primary economic risk lies in the relation between the power to be installed and the capacity of the geothermal field to supply this power for a time period sufficient to amortize the investment. This risk is analyzed, considering both the capital investment and the operating costs. (JSR)

ENVIRONMENTAL ASPECTS AND WASTE DISPOSAL

REFER ALSO TO CITATION(S) 51245

51367 (CAEC—011) **Environmental analysis for geothermal energy development in the Geysers Region: executive summary.** Dorset, P.F. (California Energy Resources Conservation and Development Commission, Sacramento (USA)). May 1978. 21p. California Energy Resources Conservation and Development Commission, Sacramento, CA.

The following are summarized for the Geysers—Calistoga KGRA: geothermal resource development, highlights of the master environmental assessment, control technology for hydrogen sulfide emissions, meteorological/climatological data base for hydrogen sulfide predictions, and future research needs. (MHR)

51368 (UCRL—15049) **Occupational hazards associated with geothermal energy.** Hahn, J.L. (California Dept. of Health Services, Berkeley (USA)). 20 Jul 1979. Contract W-7405-ENG-48. 4p. (CONF-790906—7). Dep. NTIS, PC A02/MF A01.

From Geothermal Resources Council annual meeting; Reno, NV, USA (24 Sep 1979).

Exposure to noise, H_2S, NH_3, hazardous chemicals and wastes, and heat are the major occupational health hazards associated with geothermal energy development - from drilling to power production. Exposures to these agents, although not unique to geothermal energy development, occur in situations peculiar to the industry. Reports show that occupational illnesses associated with geothermal energy development are increasing, while the corresponding rates from all power production are decreasing. Most of those related to geothermal energy result from the H_2S-abatement systems used in response to environmental pollution regulations.

51369 (UCRL—52496(Vol.6)) **Environmental overview of geothermal development: The Geysers-Calistoga KGRA. Volume 6. Water quality.** Pimentel, K.D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Oct 1978. Contract W-7405-ENG-48. 54p. P 04/MF A01.

This report identifies key issues, assesses available information, and recommends research related to water quality degradation resulting from geothermal development in The Geysers-Calistoga Known Geothermal Resource Area. Data necessary for making decisions to minimize damage while allowing development is lacking in three areas: For the whole KGRA, there is insufficient information on the relation of industry-related construction to erosion, with its resulting increase in sediment and silt in area streams. The effects of cooling tower drift on soils and vegetation near power plants should be studied as precursors of potential effects on water quality. For the hot-water resource area in the eastern portion of the KGRA, a long-range program of water quality monitoring is needed to establish a baseline.

51370 (UCRL—82871) **Water-related impacts of geothermal energy production in California's Imperial Valley.** Layton, D.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Jul 1979. Contract W-7405-ENG-48. 8p. (CONF-790906—18). P 02/MF A01.

From Geothermal Resources Council annual meeting; Reno, NV, USA (24 Sep 1979).

To successfully develop the geothermal resources of the Imperial Valley, adequate supplies of cooling water must be obtained. The primary sources of water include waste waters from agricultural lands, condensate from flashed-steam facilities, and irrigation water. The major advantages and disadvantages of these supplies are examined and then the consequences of adopting six sets of water policies to support three scenarios of geothermal energy production are assessed. The assessment includes analyses of potential constraints to development as a result of restrictive water policies. It also includes predictions of changes in the Salton Sea's elevation and salinity caused by the consumption of agricultural drain water for cooling.

51371 (UCRL—82996) **Investigation of ecosystems impacts from geothermal development in Imperial Valley, California.** Shinn, J.H.; Ireland, R.R.; Kercher, J.R.; Koranda, J.J.; Tompkins, G.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 13 Jul 1979. Contract W-7405-ENG-48. 5p. (CONF-790906—13). P 02/MF A01.

From Geothermal Resources Council annual meeting; Reno, NV, USA (24 Sep 1979).

A summary of three years of field ecological investigation in Imperial Valley Environmental Program is presented. The potential terrestrial habitat impacts of geothermal development are discussed for shorebirds and waterfowl habitat, the endangered clapper rail, powerline corridors, noise effects, animal trace element burdens, and the desert community. Aquatic habitats are discussed in terms of Salton Sea salinity, effects of geothermal brine discharges to the Salton Sea, trace element baselines, and potential toxicity of brine spills in freshwater. Studies of impacts on agriculture involved brine movement in soil, release of trace metals, trace element baselines in soil and plants, water requirements of crops, and H_2S effects on crop production in the presence of CO_2 and ozone.

51372 (UCRL—83009) **Automated system for membrane filtration and core tests.** Hasbrouck, R.T.; Owen, L.B.; Netherton, R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 2 Jul 1979. Contract W-7405-ENG-48. 6p. (CONF-790906—16). P 02/MF A01.

From Geothermal Resources Council annual meeting; Reno, NV, USA (24 Sep 1979).

An existing manually operated LLL system for obtaining data on injectability of geothermal effluents has been automated. Membrane filters and core samples are exposed to geothermal brine at representative injection pressure and formation confining pressure to study the potential effects of scaling and suspended solids deposition on the performance of injection wells. An electronic controller provides for operation under conditions of either constant differential pressure or constant flow. A data logger is used to obtain continuous records of all major system parameters. The new system is being used to assess the injectability of effluents produced by Magma Power Company's reaction clarifier-filter preinjection treatment facility operated in conjunction with the Geothermal Loop Experimental Facility at the Salton Sea Geothermal Field, Southern California.

51373 (UCRL—83010) **Effective H_2S abatement process using geothermal brine effluents.** Quong, R.; Knauss, K.G.; Stout, N.D.; Owen, L.B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Jul 1979. Contract W-7405-ENG-48. 4p. (CONF-790906—17). P 02/MF A01.

From Geothermal Resources Council annual meeting; Reno, NV, USA (24 Sep 1979).

A simple and potentially inexpensive method for removal of H_2S from noncondensible gases evolved in geothermal flash processes has been successfully tested on a small scale in the field. The method consists of scrubbing the noncondensible gases of H_2S with brine effluents which contain relatively high concentrations of Pb, Zn, and Fe such as those of the Salton Sea and Brawley Geothermal Fields in the Imperial Valley, California. For plant applications, noncondensibles including H_2S would be ejected from a surface steam condenser (necessary to minimize the volume of liquid in contact with H_2) and scrubbed with effluent brine just prior to preinjection clarification. The metal sulfide precipitates are removed in the clarification step and the noncondensibles, less H_2S, are vented as usual.

51374 (UCRL—83011) **Using surface waters for supplementing injection at the Salton Sea Geothermal Field (SSGF), Southern California.** Raber, E.; Owen, L.B.; Harrar, J.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Jul 1979. Contract W-7405-ENG-48. 5p. (CONF-790906—15). P 02/MF A01.

From Geothermal Resources Council annual meeting; Reno, NV, USA (24 Sep 1979).

The flash-steam conversion cycle is most suitable for electric power production at the SSGF. However, large-scale development of the SSGF may require use of makeup water supplements to injected brine for a viable reservoir pressure maintenance program. Since steam condensate will probably be required to satisfy power plant cooling needs, local surface waters have been evaluated for their potential use as sources of injection makeup. It was found that direct injection of untreated makeup water is not feasible because of high suspended solids loading and potential incompatability problems. However, mixtures of ambient temperature makeup water and higher temperature (80 to 90°C) brine effluent, in a 1:4 mass ratio, are potentially injectable following processing by reaction clarification and granular media filtration.

51375 **Geothermal fluid chemistry and human health.** Ellis, A.J. (Department of Scientific and Industrial Research, Lower Hutt, New Zeland). pp 727-743 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

Several effects on the environment arising from the utilization of geothermal resources which may affect human health are: (1) Human surroundings: changes in niose level, local climate, and landscape. (2) Water pollution: hot water geothermal fields emit large quantities of saline fluids which contain fluoride, boron, arsenic, and minor amounts of other heavy metals. Heavy metal sulphide precipitates form from some geothermal waters and collect in river sediments. Processing of geothermal waters to remove heavy metals may be necessary. Sulphide, boron, ammonia, and mercury may also enter local waters from geothermal steam condensates. (3) Air pollution: emission of CO_2 and H_2S from geothermal power stations in some extreme cases may approach the outputs from similar-sized coal-fired stations. Sulphide emission can be controlled by chemical processing of condensate and waste gases. Mercury from geothermal steam is unlikely to cause local levels in air to rise by more than 1 ppB. The significant environmental problems from geothermal development are capable of technical solution but add significantly to the cost of geothermal power.

51376 **Environmental aspects of geothermal energy in Latin America.** Cuellar, G. (Comision Ejecutiva Hidroelectrica del Rio Lempa, Soyapango, El Salvador). pp 745-759 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The residual fluids produced by geothermal fields are accompanied by high concentrations of chemical components which can affect the environment. Different alternatives for minimizing these impacts are analyzed. The ones adopted would be those most functional for a given locality.

51377 **Environmental impact of geothermal energy with particular reference to radioactivity.** Dall'Aglio, M. (Comitato Nazionale Energia Nucleare, Rome, Italy). pp 761-775 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

A broad picture is given of the environmental impact of geothermal energy with respect to its arrival at the surface and to the dispersion of toxic elements originating naturally as a result of the hydrothermal circulation existing before the exploitation of the geothermal field. With respect to the impact of geothermal energy on the environmental radioactivity, numerous data are given on the radon content both in Italian geothermal fields and in important Italian hydrothermal systems. The solution to the problem of environmental protection must be found in an interdisciplinary planning which will examine the interconnections between exploration, processing of the fluids for the recovery of useful and toxic elements, and suitable managment of the residual fluids, by reinjection for example.

51378 **Disposal of geothermal wastes.** Mercado, S. (Comision Federal de Electricidad, Mexico City, Mexico). pp 777-799 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

Geothermal energy presents some pollution problems different from the pollution or contamination problems occasioned by the use of fossil or nuclear fuels. If the wastes are not adequately disposed of, grave pollution problems can result or this can be the limiting factor in electricity generation. The principal contaminants in the exploitation of water systems are waste brines and gases and in gas systems, gases. The disposal of brines varies depending on the means and limitations existing in the area; the brines can be put in evaporation lagoons, reinjected into the ground, or sent to the sea. The disposal of gases, whose principal pollutant is H_2S, can be achieved by high altitude dispersion when the quantity is low. It can be converted to sulfur or sulfates when the quantity is high or when the restrictions on environmental pollution are very strict.

51379 **CO_2 distribution in the atmosphere and noise survey after blow-out in Alfina 1 well, Northern Latium, Italy.** Ferrara, G.C. (ENEL, Pisa, Italy); Stefani, G. pp 803-821 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

A water-dominated geothermal reservoir, with a gas cap (mainly CO_2) on the reservoir roof, was individuated in Torre Alfina zone, northern Latium, about 30 km south-east of Monte Amiata. The first exploratory well (Alfina 1), drilled in 1973, blew-out spontaneously so that no production casing could be inserted. After well shut-in several surface gas manifestations appeared which were considered of some risk to the environment. This paper describes the methods used to determine the degree of pollution and the total area involved. The study of the gas dispersion in the atmosphere, the noise resulting from production, and the meteorological conditions in the area, was used in drawing up a disposal plant project; this plant will be assembled on future wells as a safety measure where large quanitites of fluids are involved.

GEOTHERMAL POWER PLANTS

REFER ALSO TO CITATION(S) 51366, 51403

51380 Utilization of endogenous fluids for energy production. Saccenti, G. (ENEL, Firenze, Italy). pp 357-384 of International symposium on geothermal energy in Latin America. Rome Italy; Instituto Italo-Latinoamericano (1977). (In Italian)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

This report discusses the utilization of geothermal fluids for the production of energy in general and of electricity in particular. The various possible modes of using this form of energy are examined. The equipment necessary for the transport of the endogenous fluid and the machinery used in production centers are reviewed. The relative design criteria, the problems resulting from the nature of the fluids themselves, and the expedients adopted in the construction and operation to reduce the damage as much as possible are illustrated.

51381 Present status of geothermal energy in Mexico. De La Parra Davalos, R. (Comision Federal de Electricidad, Mexico City, Mexico). pp 895-916 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The geothermal situation in Mexico is described with emphasis on the exploitation of endogenous steam for power generation at the Cerro Prieto geothermal field. The costs and results of operation of this 75 MW geothermal power plant are indicated. The program of geothermoelectric works and the future possibilities of geothermal energy in the electric development of the country are described.

DESIGN AND OPERATION

51382 Harnessing the geothermal fluid of the Ahuachapan field (El Salvador). Baldo, L.; Cozzini, M.; Carrena, E. (ELC, Milan, Italy). pp 411-431 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The development and exploitation of the Ahuachapan Field, where initial studies were begun in 1953, is outlined. The production of vapor and discharge of the residual waters, type and power of the generators, equipment design, and construction and operation of the power plant are described in detail. (JSR)

POWER PLANT SYSTEMS AND COMPONENTS

51383 Hybrid fossil-geothermal power plants. Khalifa, H.E.; DiPippo, R.; Kestin, J. (Brown Univ., Providence, RI). pp 960-970 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

The concept of hybrid utilization of fossil and geothermal energy is discussed. Generalized performance measures are defined. The concept is applied to two types of plant: the geothermal-preheat hybrid and the fossil-superheat hybrid. In the first, the geothermal fluid is used for preheating the feedwater in a Rankine steam power cycle; in the second, steam produced by flashing a geothermal fluid is superheated in a fossil-fired superheater. Both hybrid systems are described and analyzed; figures of merit are computed for each. Results are given for a typical case of a geofluid at 200°C, and how that a geothermal-preheat hybrid plant can produce 4% more work than could be obtained from using the fossil fuel in a state-of-the-art power plant, or 60% more work than a state-of-the-art geothermal plant could yield, for the same input. For the fossil-superheat hybrid plant, the corresponding figures are 26% for fossil usage and 8% for geothermal usage. Several other promising hybrid arrangements under investigation are described briefly.

51384 Considerations and calculations on the necessity of make-up water in the cooling tower of a geothermal electric power plant. Zancani, C. (Electroconsult, Milan, Italy). pp 697-719 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

After an illustration of the method of graphic calculation to establish the state of the atmosphere at the output of the cooling tower and consequently the loss of water by evaporation, it is concluded that theoretically there is no necessity for make-up water other than the condensed geothermal steam. Some discussion is given on the chemical-physical phenomena accompanying the cooling process.

GEOTHERMAL ENGINEERING

51385 Production technology in the exploitation of geothermal fields. Giovannoni, A. (ENEL, Firenze, Italy). pp 325-356 of International symposium on geothermal energy in Latin America. Rome Italy; Instituto Italo-Latinoamericano (1977). (In Italian)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The great importance that geothermal energy has assumed in recent years as a primary source to supplement other traditional sources has favored the technological development of activity connected with the production of endogenous fluids. The most modern and advanced methodology used in the exploration and exploitation of hydrocarbon deposits have been applied, although modified and adapted, also to geothermal fields. The present dissertation makes an examination of the perforation technology with its relative difficulties and implications, synthesizes the techniques used in well completion and in the stimulation of the goethermal drilling, summarizes the methods used for the measurment of the physical parameters relative to the fluids in the well and at the surface, and describes the most wide-spread techniques for their transport. The present status of knowledge in the field of reservoir engineering is indicated.

DRILLING TECHNOLOGY AND WELL HARDWARE

REFER ALSO TO CITATION(S) 51360, 51361, 52072

51386 (SAND—79-0364C) **Design and use of polycrystalline diamond compact drag bits in the geothermal environment.** Varnado, S.G.; Huff, C.F.; Yarrington, P. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 9p. (CONF-790913—3). P 02/MF A01.

From 54. annual technical conference and exhibition; Las Vegas, NV, USA (23 Sep 1979).

The potential for utilizing polycrystalline diamond compact (PDC) cutters to provide high performance bits has been recognized by the drilling industry. New bit designs suitable for geothermal drilling are being developed based on the results of single cutter laboratory tests and analytical analyses. A new bonding technique for attaching the cutters to the bit body has been developed. Bits using this new technique have been built and tested with promising results. The results of single cutter tests, the bit design philosophy, the bonding process for attaching the cutters to the bit body, and the results of laboratory and field tests of these new bit designs are described.

51387 Control of a geothermal field after damage to the prodcution casing. Cigni, U.; Del Gaudio, P.; Quintavalle, L. (ENEL, Larderello, Italy). pp 553-570 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

In July 1975 deep craters began to appear in the zone surrounding Travale 22 well (200 t/h of steam with high thermodynamic characteristics, 250°C, atm well-head pressure in operating conditions). These were followed by the uncontrolled eruption of steam through the wide holes that appeared in the surrounding terrain, causing serious danger to both human life and the buildings in the zone. A series of operations had to be carried out immediately in order to avoid any danger and also to protect the potentiality of the entire geothermal field at Travale. The detailed work plan included the drilling of two directional wells and the design and construction of special equipment for lowering into a flowing well, so that, one year later, the well could be killed, a new production casing lowered and a complete work-over effected on the well. A detailed description is given of the various operations involved in work-over of the well.

FLUID TRANSMISSION

51388 Numerical simulation of a network of steam pipes. Marconcini, R.; Neri, G. (ENEL, Firenze, Italy). pp 645-663 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Italian)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The present work describes a computer program to simulate the behavior of a steam pipe network, such as that in operation in the Larderello geothermal field, fed by superheated steam. Some applications of the program to a network in operation are shown.

CORROSION, SCALING, AND MATERIALS DEVELOPMENT

REFER ALSO TO CITATION(S) 51968

51389 (PB—288121) **Linear polarization measurements at high temperatures in hypersaline geothermal brines. Report of investigations.** Cramer, S.D.; Needham, P.B. Jr. (Bureau of Mines, Washington, DC (USA)). 1978. 20p. Y A02/MF A01.

The Bureau of Mines conducted a series of in situ linear polarization measurements in high-temperature, high-pressure hypersaline geothermal brines at the Bureau of Mines Geothermal Test Facility in the Imperial Valley of California. The measurements represented an evaluation of the linear polarization technique for obtaining instantaneous corrosion rates of materials of construction in flowing hypersaline hydrothermal fluids that rapidly form scales on exposed surfaces. A special method was devised for use with the linear polarization technique that resulted in obtaining corrosion rates for 1020 carbon steel, 316 and 430 stainless steel, titanium, various nickel-based alloys, and aluminum 6061 under strong scale-forming conditions. The measurements also provided information on scale-deposition rates in various geothermal environments. Exploratory in situ potentiostatic polarization measurements were made in the flowing brines to qualitatively determine scale-deposition effects on the electrochemical measurements.

51390 (UCID—18230) **Failure analysis of a Hastelloy C-276 geothermal injection pump shaft.** Tardiff, G.E.; Snell, E.O. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 Jul 1979. W-7405-ENG-48. 7p. P 02/MF A01.

A metallurgical analysis of a fractured Hastelloy C-276 brine injection pump shaft was carried out to determine the cause of failure. Loss of load carrying cross section due to intergranular corrosion by molten bronze bearing alloy followed by torsional overload of the remaining section was the cause of failure. Lack of evidence for brine induced corrosion or stress corrosion of the Hastelloy C-276 alloy is consistent with prior successful experience with this material in contact with high temperature, high salinity Salton Sea Geothermal Field brines.

51391 (UCRL—83013) **Computer simulation of temperature-dependent equilibrium precipitation.** Wolery, T.J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Jul 1979. Contract W-7405-ENG-48. 4p. (CONF-790906—9). P 02/MF A01.

From Geothermal Resources Council annual meeting; Reno, NV, USA (24 Sep 1979).

The EQ3/EQ6 software package contains two computer codes (EQ3 and EQ6) and data files which form a useful tool in modeling precipitation from geothermal fluids caused by heating or cooling. The data files contain information on 140 aqueous species and nearly 150 minerals, and permit calculations over the temperature interval 0 to 350°C. Assumption of homogeneous thermodynamic equilibrium in aqueous solution permits calculation of the driving forces for precipitation as measured by the affinity (log Q/K) for each such reaction. Further assumption of precipitation and heterogeneous equilibrium for any mineral whose affinity would otherwise exceed a value of zero permits determination of the identity of the precipitates, their masses and volumes, and the temperature ranges in which they form. The EQ3/EQ6 capability was used to determine the effects of temperature increase on formation of precipitates form Salton Sea water.

51392 **Problems in the operation of the geothermal wells of Cerro Prieto.** Guiza Lambarri, J. (Comision Federal de Electricdad, Mexico City, Mexico). pp 605-617 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

Of the 32 deep geothermal wells drilled in Cerro Prieto, Baja California, Mexico, only two have detected no hot zones. In actuality, 16 of these wells are connected to supply vapor to the geothermal plant of 75,000 kW capacity, which was inaugurated in 1973 and has been in operation since then. The principal problems found are: incrustation of the production piping, failure of the well casings, and some isolated cases of erosion of valves and joints of the surface installations for hauling sand. In order to solve the first of these problems, various methods of descaling were tested. Increasing the thickness of the piping and using larger capacity joints were tried for the second problem. The third problem is not in reality a serious problem because of its infrequency.

GEOTHERMAL RESERVOIR AND WELL PERFORMANCE

REFER ALSO TO CITATION(S) 51346, 51356

51393 (LBL—9463) **Site specific geothermal reservoir engineering activities at Lawrence Berkeley Laboratory.** Goranson, C.B.; Schroeder, R.C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1979. Contract W-7405-ENG-48. 5p. (CONF-790906—12). P 02/MF A01.

From Geothermal Resources Council annual meeting; Reno, NV, USA (24 Sep 1979).

The studies have included cooperative projects with several private companies, city governments, and federal agencies. The purpose has been to develop new and improved techniques, tools, and analysis methods for use in assessing and modeling hydrothermal systems. The important tasks in carrying out these activities can be summarized as follows: collect site specific data, develop field techniques, develop measurement tools, develop analysis methods, and model site specific aquifers.

51394 (LBL—9569) **Status of the resource evaluation at Susanville, California.** Benson, S.M.; Goranson, C.B.; Haney, J.P.; Schroeder, R.C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1979. Contract W-7405-ENG-48. 5p. P 02/MF A01.

The Bureau of Reclamation and Lawrence Berkeley Laboratory have collaborated on a resource evaluation project at Susanville, California. The project has included drilling exploratory wells, well logging,, subsurface geological studies, hydrothermal measurements, and numerical calculations. The studies show that the portion of the resource above 40°C is partially confined both laterally and vertically. The areal confinement is on three sides of the northwest trending anomaly. The total areal extent to the northwest has not yet been determined. The vertical confinement appears to be related to the presence of fractures at the agglomerate-basalt interface in the southern portion of the anomaly. Well tests show a high permeability and low storativity (in general), which are consistent with a fracture dominated flow system. Cores from newly drilled wells also show large numbers of fractures with relatively small matrix permeability.

51395 (UCRL—83012) **Tidal pressure response as a reservoir engineering tool.** Hanson, J.M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Jul 1979. Contract W-7405-ENG-48. 5p. (CONF-790906—10). P 02/MF A01.

From Geothermal Resources Council annual meeting; Reno, NV, USA (24 Sep 1979).

Fluid pressure oscillations resulting from tidal strain reflect hydrologic and elastic properties of a reservoir. Precise measurement and interpretation of these pressure fluctuations has the potential of being a useful quantitative reservoir engineering tool. Interpretations of reservoir response to tides have been to date of a qualitative nature. This is primarily due to the lack of resolving power of the spectral analysis techniques applied in the data interpretation. We have developed a procedure, based on the statistical nature of the noise in the signal, that overcomes most of these problems. The method quantifies the spectral resolution in terms of an absolute confidence level in both amplitude and phase of the spectral estimate. Analysis of one week of data from a well in the Salton Sea KGRA is presented.

51396 **Gas—water interface rise during early exploitation test in Alfina geothermal field (Northern Latium, Italy).** Barelli, A. (ENEL, Pisa, Italy); Celati, R.; Manetti, G. pp 433-449 of International symposium on geothermal energy in Latin America. Rome, Italy; INstituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

Alfina geothermal field is made up of a gas-cap (CO_2) overlying an almost closed aquifer. The wells drilled in the highest part of the reservoir produce gas while the others either produce hot water or are sterile. During the first production tests the analysis of pressure and water-levels showed that the gas—water interface had risen. This was later confirmed when a gas-producing well began carrying water. This paper attempts to explain field behaviour by means of simple calculations and assuming an idealized geological structure. This study gives an estimation of the average porosity and initial gas in place.

51397 **Ahuachapan geothermal field after one year of exploitation.** Choussy, M.E.; Penate, T.S. (Comision Ejecutiva Hidroelectrica del Rio Lempa, Soyapango, El Salvador). pp 527-552 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The present work attempts to establish the actual conditions of some of the physico-chemical characteristics of the Ahuachapan geothermal field after one year of intensive exploitation. Some hypotheses on the changes which are occurring in the production characteristics and in the composition of the discharged fluids are presented.

RESERVOIR STIMULATION AND EXTRACTION TECHNOLOGY

51398 (LA-UR—79-1920) **Hot dry rock geothermal heat extraction.** Murphy, H.D. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 5p. (CONF-790906—8). P 02/MF A01.

From Geothermal Resources Council annual meeting; Reno, NV, USA (24 Sep 1979).

A man-made geothermal reservoir has been created at a depth of 2.7 km in hot, dry granite by hydraulic fracturing. The system was completed by directionally drilling a second well in close proximity with the top of the vertical fracture. In early 1978 heat was extracted from this reservoir for a period of 75 days. During this period thermal power was produced at an average rate of 4 MW(t). Theoretical analysis of th measured drawdown suggests a total fracture heat transfer area of 16,000 m^2. Viscous impedance to through-flow declined continuously so that at the end of the experiment this impedance was only one-fifth its initial value. Water losses to the surrounding rock formation also decreased continuously, and eventually this loss rate was less than 1% of the circulated flow rate. Geochemical analyses suggest that, with scale up of the heat transfer area and deeper, hotter reservoirs, hot dry rock reservoirs can ultimately produce levels of power on a commercial scale.

DIRECT ENERGY UTILIZATION

REFER ALSO TO CITATION(S) 51363

51399 (DOE/ET/248447—1) **Multi-use geothermal energy system with augmentation for enhanced utilization. Non-electric application of geothermal energy in Susanville, California. Final report.** Olsonn, G.K.; Benner-Drury, D.L.; Cunnington, G.R. (Aerojet Energy Conversion Co., Sacramento, CA (USA)). Feb 1979. Contract ET-78-C-03-1740. 200p. P 09/MF A01.

Aerojet Energy Conversion Company has completed a site specific engineering and economic study of multi-use, augmented geothermal space/water heating and cooling systems in cooperation with the City of Susanville, California. The overall benefits to the City of Susanville, in both the public and private sectors, of using low temperature (150°F to 240°F) geothermal resources are explored. Options considered, alone and in combination, include heat pumps, fossil-fuel peaking, user load balancing, and cascading from the geothermal system serving the public buildings into a private Park of Commerce development. A range of well temperatures, depths, flow rates, and drilling costs are considered to provide system cost sensitivites and to make the study more widely useful to other sites. A planned development is emphasized for ease of financing and expansion. A preliminary design of Phase A of a Susanville Public Building Energy System and a conceptual design of an integrated park of Commerce, Phase I, are included. This system was designed for a 150°F resource and can be used as a model for other communities with similar resource temperatures.

51400 **Non-electric uses of endogenous fluids at Larderello.** Allegrini, G. (ENEL, Firenze, Italy). pp 393-409 of International symposium on geothermal energy in Latin America. Rome Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The non-electric uses of endogenous fluids in a vapour-dominated field such as that of Larderello are described. This type of utilization, more than a century old by now, is of secondary interest compared to electricity generation and is directed more towards the lower enthalpy fluids. After a preliminary examination of the chemico-physical characteristics of the fluids the paper deals with the problems arising from the presence of uncondensable gases and corrosion, erosion and scaling. A brief description is also given of the plants used. Finally, the economic importance of this utilization to the zone is also discussed.

51401 **Production of fresh water from geothermal fluids.** Espinosa, R.B. (Energia Geotermica, Santiago, Chile). pp 451-459 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977). (In Spanish)

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

This paper describes briefly a method by which it is possible to obtain pure water from geothermal fluids and indicates the necessity of continuing investigations in this area. A brief description is given of the plant. The results obtained show that pure water can be obtained without using any fuel in the process except for pumps and instrumentation.

51402 **Opportunities for direct use of geoheat in Central America and other tropical countries.** Einarsson, S.S. (United Nations, New York, NY). pp 585-603 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

While present efforts are primarily aimed at electric power generation, direct use of geoheat is an important means of saving petroleum. In Iceland, for instance, geoheat has primarily been used for non-power purposes such as house heating and in industries. Its use has been increasing by about 10% annually for more than 15 years. Technical, economic and institutional aspects of geoheat utilization are discussed. It is found that prolific opportunities exist for use of geoheat in agro-industrial processing in the tropical countries like Central America, and a number of potential applications are mentioned. The cane sugar industry for instance seems to offer important possibilities, since the introduction of geoheat could release the bagasse as raw material for byproduct industries of great economic importance. Geoheat could also provide pulp and paper industries based on fast growing species of pulpwood with heat energy at great savings. Potential geoheat applications in Central America could be equivalent to millions of barrels of petroleum in terms of energy.

51403 **Varied use of geothermal energy in Iceland.** Lindal, B. (VIRKIR, Reykjavik, Iceland). pp 619-643 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

Geothermal applications are described and indicated on a map. They are space heating, process heating, greenhouse applications, balneology aquaculture, and electric power. The process heating applications include a diatomite plant, seaweed plant, grass and vegetable drying, stock fish drying plants, wool washing and drying, and curing insulating bricks. (MHR)

51404 **Escalofriarse?... Geothermal heat will energize refrigerated cooling.** Wehlage, E.F. (International Society for Geothermal Engineering, Whittier, CA). pp 665-695 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The potential for understanding and using geothermal heat and energy in the Latin American countries appears to be accepted with a special appreciation that opens doors for new and unique services. The systems that might apply for cooling by geothermal heat are reviewed. This paper suggests by-passing electrical power used for compression work with geothermal heat using an ammonia—water binary couple producing low temperature. It also considers a proposal made to demonstrate a small system designed for domestic air conditioning service; the developing possibility of heat pump (a refrigeration cycle) applications using warm geothermal fluids (say + 40°C) for cooling and heating; and modern heat pump equipment delivering 110°C process water from +- 40°C geothermal fluids. The various parameters discussed include: (1) temperatures of fluid after cooling; (2) geothermal fluid temperature versus duty; (3) heat rejection/application temperatures; (4) << cascading >> of geothermal cooling levels; (5) << bootstrapping >> with fossil fuels; (6) domestic cooling units; (7) commercial space heating and cooling with geothermal source heat pumps; (8) hot water from geothermal source heat pumps working in an industrial temperature range; and (9) special study based on future Latin American geothermal prospects combined with electrical power development.

GEOTHERMAL DATA AND THEORY

51405 **Geophysics and geothermal research.** Banwell, J.C. pp 71-76 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The distinction is made between research and exploitation. Research is classified by applied, theoretical reservoir models, fundamental research on heat sources, and exploration by deep drilling. (MHR)

PROPERTIES OF AQUEOUS SOLUTIONS

REFER ALSO TO CITATION(S) 51391

PROPERTIES OF MINERALS AND ROCKS

51406 (LA—7923-MS) **Uranium, thorium, and lead concentrations and lead isotopic composition of biotite granodiorite (sample 9527-2b) from LASL Drill Hole GT-2.** Zartman, R.E. (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG-36. 20p. P 02/MF A01.

An investigation of the uranium (U), thorium (Th), and lead (Pb) isotopic systematics was made on the whole rock, microcline, plagioclase, biotite, sphene, zircon, epidote, and pyrite of a biotite granodiorite (core sample 9527-2b) obtained from a depth of almost 3 km in Los Alamos Scientific Laboratory's (LASL) deep drill hole GT-2. Except for quartz, magnetite, and apatite, all primary mineral phases were analyzed, as were epidote and pyrite from minute epidote—calcite—pyrite veinlets formed during a later fracture filling event. The sphene and zircon data offer strong support for an initial crystallization age of about 1500 +- 20 m.y for the biotite granodiorite. Likewise, a model age of about 1500 m.y. is calculated for the microcline. This amount of time is also required for the whole rock to evolve essentially as a closed system from an initial lead isotopic composition similar to that of the microcline. The plagioclase and biotite, on the other hand, clearly record isotopic disturbance at some time(s) subsequent to the crystallization of the rock. The isotopic systematics of the secondary epidote and pyrite do not allow for a unique determination of the age of the fracture-filling event, but suggest a more complex history of chemical migration extending perhaps from Precambrian to Phanerozoic time.

ISOTOPE AND TRACE ELEMENT STUDIES

51407 Environmental isotopes in geothermal studies. Panichi, C. (CNR, Pisa, Italy); Gonfiantini, R. pp 29-70 of International symposium on geothermal energy in Latin America. Rome, Italy; Instituto Italo-Latinoamericano (1977).

From Geothermal conference; Guatemala City, Guatemala (18 Oct 1976).

The mean abundances in natural compounds of the main environmental isotopes used in hydrology are reported. The major features of the environmental isotopes of hydrogen and oxygen in groundwater studies are summarized. Environmental isotopes applied to the hydrological study of geothermal fields and isotopic geothermometers are discussed. (MHR)

WIND ENERGY

AVAILABILITY (CLIMATOLOGY)

REFER ALSO TO CITATION(S) 51214

51408 (HCO/T1041—01) **National wind data index. Final report.** Changery, M.J. (National Climatic Center, Asheville, NC (USA)). Dec 1978. Contract EX-76-A-29-1041. 231p. Dep. NTIS, PC A11/MF A01.

The index is intended as a guide to the identification of all locations in the United States with original wind data in any form that have been archived at the National Climatic Center. Data in the NCC archives have been recorded by the National Weather Service and its predecessor agencies, the US military services including the Coast Guard, the Federal Aviation Administration, and other weather reporting facilities. Wind summaries have been produced for many locations for various periods of record. Those available through the Center have been documented in a previous publication. For most locations, however, the data remains as unsummarized manuscript and/or autographic records. A significant portion of the data has been observed at stations where no data have been recorded during the past 20 to 30 years.

51409 Wind energy conversion. Fejer, A.A. (Illinois Inst. of Tech., Chicago). pp 399-422 of Energy from the sun. Chicago, IL; Institute of Gas Technology (1978).

From Symposium on energy from the sun; Chicago, IL, USA (3 Apr 1978).

Effective utilization of wind energy requires systematic studies of the sites available for the location of wind energy conversion systems and careful evaluation of the type and size of machines to be used. The present paper describes an approach currently in use for the siting of wind generators. It describes also the aerodynamic features of various types of wind machines and indicates the present status of development and prospects of horizontal axis propeller type and vertical axis Darrieus turbines.

ECONOMICS

51410 (DOE/EIA—0164(75-76)) **Wind energy conversion systems manufacturing and sales activity, 1975 and 1976.** Parker, N.; Walton, H. (Department of Energy, Washington, DC (USA). Energy Information Administration). Apr 1977. 12p. (PB—265823; FEA/B—77/121). NTIS, PC A02/MF A01.

Results are presented of an annual survey of private firms engaged in the manufacturing and distribution of wind energy conversion systems in the United States during the years 1975 and 1976. Imports of systems manufactured abroad for distribution in the United States are also included.

51411 (DOE/ET/4053—78/1) **Economic incentives to wind systems commercialization. Final report.** Lotker, M.; Shaw, R.W. Jr.; Adolfson, W.F.; Bernardi, R.P.; Davidoff, P.H.; Eckhart, M.T.; Gunwaldsen, D.S.; Mettam, P.J.; Narayanan, P.; Sillin, J.O. (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). Aug 1978. Contract EG-77-C-01-4053. 36p. P 16/MF A01.

This assessment of Economic Incentives to Wind Systems Commercialization is an analysis of the quantitative and qualitative impacts of a variety of Government funded economic incentives on Wind Energy Conversion Systems (WECS). The purpose of this study is to achieve better understanding of the relationship between implementation of specific economic incentives for WECS, and the factors surrounding WECS commercial introduction.

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 51227

51412 (DOE/EDP—0030) **Environmental development plan wind energy conversion.** (Department of Energy, Washington, DC (USA)). Jul 1979. 34p. P 03/MF A01.

The Environmental Development Plan (EDP) system is designed to provide a common basis for planning, managing, and reviewing the environmental aspects of the various energy technology programs under the Department of Energy's (DOE) jurisdiction. The publication of an EDP is generally timed to precede key technology program decisions that result in program shifts from an exploratory development into the technology development or engineering development phase. The time frame covered by an EDP generally encompasses all significant decision points relating to the technology program. Projects or subprograms that are likely to result in a demonstration or commercialization within the near term are presented in detail. Projects that will need to be considered in greater detail in the next EDP update are identified.

WIND ENERGY ENGINEERING

TURBINE DESIGN AND OPERATION

REFER ALSO TO CITATION(S) 51409

51413 (SAND—79-1068) **Characteristics of futre vertical-axis wind turbines.** Kadlec, E.G. (Sandia Labs., Albuquerque, NM (USA)). Jul 1978. Contract EY-76-C-04-0789. 20p. P 02/MF A01.

As a DOE facility, Sandia Laboratories is developing Darrieus vertical-axis wind turbine (VAWT) technology. The objective of this technology is to assess the practicality of wind-energy systems for low-cost production and commercial marketing by private industry. This report describes the characteristics of current technology designs and assesses their cost-effectiveness. Better aerodynamics and future structural requirements combine for potential energy cost reductions of 35 to 40%.

SITE CHARACTERISTICS

51414 (PB—287750) **New wind energy site selection methodology. Quarterly report No. 3, 17 September—16 December 1975.** Freeman, B.E. (Science Applications, Inc., La Jolla, CA (USA)). Jan 1976. Contract NSF-C1006. 74p. Y A04/MF A01.

Major emphasis was placed on the testing and application of a 3-D mesoscale computer code SIGMET on wind energy site selection. Idealized problem calculations were carried out. These included several 3-D calculations representing flow over real terrain to help determine values of input parameters for satisfactory solutions and code improvements. Investigations were continued into the development of more accurate and economical methods for mesoscale simulation. They involved the partial implication of gravity waves, turbulence formation, and more accurate advection calculations. An analytical study of stability conditions was performed to provide guidance in code design and use. Field data for validation comparisons were also obtained. The report includes a summary of field data gathering, work and calculations on the 3-D SIGMET code, and a review of new techniques and analyses.

51415 (RLO—2441-76/16) **Assessing the local wind field for siting of wind power systems. Final report, July 1976—June 1977.** MacCready, P.B. Jr. (AeroVironment, Inc., Pasadena, CA (USA)). Sep 1977. Contract EY-76-C-06-2441. 87p. P 05/MF A01.

The determining of flow field characteristics for a given wind turbine site is difficult. The best monitoring device would be some sort of remote monitor which continuously defines the entire three-dimensional flow field from ground to 100 m throughout a hilly region of, say, 5 km by 5 km. None exists. There are many alternative schemes which are available, each with its strengths and weaknesses. The schemes are examined in this report, from the perspective of their suitability for economically providing field observations with which exact sites in complex terrain can be selected. The mean wind profiles are considered to be first priority, with turbulence information secondary. Only techniques which are already operational are considered seriously here. The main attention is focused on the acoustic doppler technique.

ELECTRIC POWER ENGINEERING

REFER ALSO TO CITATION(S) 51435, 51436, 51770

POWER PLANTS AND POWER GENERATION

51416 (PB—288288) **Seismic safety of electric power equipment. Final report.** Schiff, A.J. (Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering). Jun 1977. 29p. Y A03/MF A01.

The report summarizes a two year effort to develop a methodology for the evaluation of seismic reliability of electric power equipment. It reviews the goals of research, discusses major accomplishments, and gives recommendations growing out of the research. A plan based on the objectives of the proposed research was divided into three parts. The first involves an effort to evaluate the effect of different levels of severity of unified equipment specifications on initial costs and extent of probable power disruptions. The second deals with developing methods and procedures for proof and field testing electrical equipment, and the third involves investigating the quantity and location of equipment which can serve as backup reserve for a region in the event of a catastrophic disaster. Technical reports describing the different phases of the work are included in the appendices. These include information on the impact of the study and a brief summary of sixteen papers and ten reports resulting from the research.

COOLING AND HEAT TRANSFER EQUIPMENT AND SYSTEMS

REFER ALSO TO CITATION(S) 51209, 51557, 51638

POWER CYCLES

REFER ALSO TO CITATION(S) 51205, 51383, 51807, 51826, 51841

51417 (GA—A-15322) **Closed-cycle gas turbine - a proven cogeneration plant adaptable to fossil, nuclear, and solar heat sources.** McDonald, C.F. (General Atomic Co., San Diego, CA (USA)). Jun 1979. Contract EY-76-C-03-0167. 71p. (CONF-790383—1). P 04/MF A01.

From Conference on energy conversion and solar energy; Milan, Italy (26 Sep 1979).

The paper reviews existing operational CCGT plants and projects nuclear, fossil, and solar plants of the future. Perhaps the singularly most important benefit of the CCGT is its inherent cogeneration capability. The paper concludes that worldwide efforts to bring the CCGT plant into use should increase rapidly, since this type of plant can significantly aid in meeting national energy goals. (TFD)

51418 (SAN—1207-T1) **Test results: direct contact heat exchanger for Biophase diesel bottoming system.** Helgeson, N.L.; Studhalter, W.R.; Amend, W.E. (Biphase Energy Systems, Santa Monica, CA (USA)). 5 Sep 1978. Contract EY-76-C-03-1207. 90p. P 05/MF A01.

A subscale, direct contact heat exchanger (1-ft dia packed column) was built and operated under conditions applicable to the Biphase diesel bottoming cycle. Special probes for measuring gas and liquid temperatures and for measuring gas-phase compositions were designed and installed in the exchanger. The data obtained are unique in that they indicate both the extent of evaporation and condensation zones within the exchanger and the effect that those mass transport mechanisms have upon heat exchanger performance. For gas temperatures greater than 500°F it was found that the maximum temperature to which Therminol 66 could be heated was strongly dependent upon vaporization effects. Data obtained are sufficient to provide for the preliminary design of a direct contact heat exchanger using Therminol 66 as the thermal fluid. Recommendations are made for further testing using other heat transfer fluids to derive a more general engineering approach to the design of direct heat exchangers.

WASTE-FUELED SYSTEMS

51419 (CONF-7810156—) **Installation of underground power transmission cables. Proceedings of a Department of Energy workshop.** (Bechtel National, Inc., San Francisco, CA (USA)). Jun 1979. Contract ET-78-C-01-2851. 162p. P 08/MF A01.

From Workshop for installation of underground power transmission cables; Pittsburgh, PA, USA (2 Oct 1978).

The proceedings of a Department of Energy-sponsored workshop in the installation of underground power transmission cables are reported. The workshop was held in Pittsburgh, Pennsylvania, October 2—5, 1978. Sixty-two participants, representing equipment manufacturers, utilities, contractors, universities, and government agencies, were divided into topic groups covering specific installation activities. Discussion was directed toward a review of the state of the art in underground cable installation, future equipment and technique development requirements, and the formulation of conclusions and recommendations. The principal technological problem for underground installation is the lack of ability to locate underground obstacles, principally in urban and suburban areas. Development of a sensing system to locate obstacles was given a high priority by nearly all topic groups. The lack of market definition was seen as the principal impediment to competition and development of specialized equipment. Most participants felt that the federal government must assume a role in research and development of new equipment and techniques. However, the participants did not favor increased federal regulation of underground cable installation systems.

COMPONENTS

REFER ALSO TO CITATION(S) 50996, 51965, 52086

51420 (FE—2664-T2) **Ceramic Technology Readiness program interim report: HiCAT conceptual design study.** (AiResearch Mfg. Co., Phoenix, AZ (USA)). 1 Nov 1978. Contract EF-77-C-01-2664. 133p. P 07/MF A01.

The report presents the results of the conceptual design study for the DOE sponsored Ceramic Technology Readiness (CTR) program under Contract EF-77-C-012664. The major objectives of this program are to develop ceramic technology for utility gas turbines operating at 2600°F turbine inlet temperature with uncooled turbine blades and utilizing coal-derived fuels. The CTR program objectives are met with the use of the High Temperature Ceramic Augmentation Turbine (HiCAT) concept. This concept consists of a specifically designed high-pressure ceramic turbocompressor, thermodynamically coupled to a low-pressure metallic gas turbine. The low-pressure spool is a modified Brown Boveri Type 11 gas turbine. Three HiCAT conceptual designs are presented. Each design is defined within a complete power plant configuration that includes a Lurgi coal gasification plant, HiCAT gas turbine, and a steam combined cycle.

WASTE HEAT UTILIZATION

REFER ALSO TO CITATION(S) 51792, 51820, 51839, 51882

51421 (TID—29379) **Comparison of coal-fired power systems in waste heat applications in Tacoma, Washington.** Robertson, J. (Washington State Univ., Pullman (USA). Environmental Research Center). 1979. Contract EG-77-S-05-5516. 235p. P 11/MF A01.

An analysis is undertaken of the relative advantages and disadvantages of making use of the waste stream of heat produced as a by-product of electrical power generation in a coal-fired power plant. Efficiency gains in the utilization of waste heat, and environmental impact and economic costs are compared for two types of plants supplying waste heat, and for a conventional energy-supply system that does not make use of waste heat. Small-scale (2.1-MW) Modular Integrated Utility Systems plants, as developed by Oak Ridge National Laboratory, are compared with a large (300-MW) power plant. The basis of comparison of systems is investment in an equivalent 300 MW of installed capacity. The waste-heat supplying systems are sited in a particular urban environment: Tacoma, Washington. The conventional power plant with which they are compared is remote-sited, in eastern Washington. Power plant technologies are described for all systems, as are alternative modes of operation. Waste heat is studied in the supply of two thermal loads: space heat and domestic hot water. The former is supplied by individual natural gas furnaces and the latter is part of the electrical load for the conventional system. Two types of residential end-use demand are connected to the supply modes: garden apartments and individual single dwellings. Waste heat utilization is concluded to be advantageous in efficiency of energy conversion as well as in impacts borne, and is economically competitive in most circumstances.

ECONOMICS

REFER ALSO TO CITATION(S) 51870

OFF-PEAK ENERGY STORAGE

51422 Storage as an energy strategy for utilities. Schneider, T.R. (Electric Power Research Inst., Palo Alto, CA). pp 379-386 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

The paper addresses questions concerning what energy storage is, what interest utilities have in it, what benefits it offers the operation of energy systems, and what potential options are available for storing energy. It attempts to identify how energy storage can serve to benefit US program for reducing oil consumption. The benefits for utilities from energy storage accrue from economics of operation and system operating improvements. They include: improvement in baseload plant capacity factor; production cost savings; use as spinning reserves; improved reliability; more efficient load following; and better utilization of transmission system. In the paper, the following subjects are covered: storage with solar energy; future trends - electric vehicles, load management, and time-of-day pricing; near and mid-term options for energy storage; hydro pumped storage; compressed air storage; thermal storage; battery storage comparison of technologies. (MCW)

FUELS

REFER ALSO TO CITATION(S) 51808, 51831

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 51033, 52221, 52223, 52230, 52232

51423 (PTB-Ra—8) **Emission of radioactive substances in gaseous wastes from nuclear and fossil-fuel power plants. A comparison of radiation load.** Kolb, W. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Radioaktivitaet). Feb 1978. 13p. (In German). U 02/MF A01.

Recently, the Federal Minister of the Interior issued regulations for the estimation of the radiation exposure due to airborne effluents of radioactive materials from stacks. These regulations originally intended for nuclear power plants have been applied to a coal fired power plant. A modern coal fired power plant (300 MW) emits about 500 t flyash per year into the environment, containing amongst others 1 GBq (30 mCi) ^{210}Pb and 0.15 GBq (4 mCi) ^{226}Ra. The intake of these nuclides by ingestion leads to a radiation exposure of 0.19 mJ/kg (19 mrem) for bone tissue. Nuclear power plant Stade (Lower Saxonia, 662 MW) emits averaged over one year about 0.37 GBq (10 mCi) ^{131}I resulting in a radiation exposure of 0.004 mJ/kg (0.4 mrem) for the thyroid gland. Since the risk factor for bone and that for the thyroid gland is the same it may be stated that the radiation risk in the environment of a coal fired power plant - related to the same power - is higher by a factor of 100 compared with the radiation risk near a nuclear power plant. Nevertheless it is shown, that even the very conservatively calculated figures are in both cases lower than those resulting from natural background radiation.

51424 Commentary of a methodology for assessment of the environmental impact of the electrical power system within the Connecticut River Basin. Shuster, C.N. Jr. (Federal Energy Regulatory Commission, Washington, DC). pp 403-420 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Evironmental and socio-economic conditions within the Connecticut River Basin have been considered in juxtaposition with that part of a geographically-larger electric-generating system which overlaps the basin (Shuster, Restall, and Fan, 1976). Existing and proposed bulk energy facilities were regarded as component parts of the energy system rather than as isolated projects. The purpose of analyzing such a relationship was to identify and describe large-scale, regional electric power and environmental issues, particularly cumulative impacts related to the development of electric-generating capacity in the river basin. Environmental issues related to the operation of power plants involved consideration of land and water uses and energy supply and demand including: (1) reliability of electric system and capacity for generation of electricity, (2) impact of water resource management on power generation; (3) impacts of power generation on water consumption, water diversion, water quality, and fisheries management, particularly of anadromous species; (4) extent and quality of recreation areas; and (5) shoreline erosion. This paper describes a systems approach which unites environmental impact statement and river basin studies in assessing the environmental impact of the electrical power system within the Connecticut River Basin.

NOXIOUS GAS AND PARTICULATE ABATEMENT AND CONTROL

REFER ALSO TO CITATION(S) 51045, 51052, 51787, 52145

51425 (CONF-7606131—, pp 247-265) **Suitability and availability of Texas limestone for flue-gas desulfurization.** Evans, T.J.; Moseley, M.G. (Univ. of Texas, Austin). 1978.

From Symposium of Gulf Coast lignite, geology, utilization, and environmental aspects; Austin, TX, USA (2 Jun 1976).

The proposed use of limestone-based wet scrubbers to control sulfur dioxide emissions from large powerplants in Texas focuses attention on the relative suitability and availability of Texas limestone for such use. Review of basic chemical reactions and the results of testing and analyses reported in the literature indicate that the dissolution rate of limestone particles is an important parameter affecting scrubber behavior. Several Texas limestones were collected for this study with most coming from quarries currently operating. Evaluation of these samples included spectrographic analysis, wet-chemical determination of CaO and MgO, particle-size analysis, determination of dissolution rate at constant pH in H_2SO_3, and mineral analysis from thin-section examination. Texas limestones display a wide range of dissolution rates. Factors controlling dissolution rate are related to particle surface area, as reflected by average particle size. Limestone consumption in the six Texas generators scheduled for operation with flue-gas desulfurization equipment by early 1981 is estimated to be less than 1 million tons per year. This annual requirement is only about 2 percent of the annual crushed limestone production in the State and is an insignificant part of the total estimated limestone resources (6 trillion tons) in the vicinity of the lignite-fueled powerplants. A variety of supply modes and adequate railway and highway networks insure strong competition among suppliers of limestone for flue-gas desulfurization systems. Estimated total cost per ton of limestone at the generation site ranges from $4 to $13, depending on haul distance and mode of supply.

51426 (EPRI-FP—940) **Reheat study and the corrosion—erosion tests at TVA's Colbert Pilot Plant.** Cole, R.M.; Kelso, T.M.; Robards, R.F. (Tennessee Valley Authority, Chattanooga (USA)). May 1979. 68p. P 04/MF A01.

The Tennessee Valley Authority (TVA) is actively engaged in a pilot plant program to develop and/or evaluate wet-scrubbing processes for removing sulfur dioxide (SO_2) from boiler flue gas. This program includes adjunct testing to evaluate ancillary systems and components. The Electric Power Research Institute (EPRI) funded TVA to determine the operating and heat transfer characteristics for the (1) inline-indirect steam reheater, (2) flue gas recirculation reheat system, and (3) the cyclic reheat system. Tests were also made to measure the resistance of materials of construction to erosion—corrosion by process lime/limestone slurry.

SITE SELECTION AND LAND USE

REFER ALSO TO CITATION(S) 51817

POWER TRANSMISSION AND DISTRIBUTION

51427 (DOE/ET—5041-1) **Assessment of sodium conductor distribution cable.** (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Jun 1979. Contract EC-77-C-01-5041. 271p. P 12/MF A01.

The study assesses the barriers and incentives for using sodium conductor distribution cable. The assessment considers environmental, safety, energy conservation, electrical performance and economic factors. Along with all of these factors considered in the assessment, the sodium distribution cable system is compared to the present day alternative - an aluminum conductor system. (TFD)

AC SYSTEMS, EHV AND UHV

51428 (BNL—26425) **X-ray examination of insulation in lapped high voltage underground power transmission cables.** Muller, A.C. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 6p. (CONF-791008—1). P 02/MF A01.

From ASNT fall conference; St Louis, MO, USA (15 Oct 1979).

The equipment and method used in a radiographic system for detecting defects in the electrical insulation on underground power transmission cables are described. The BNL x-ray system has been used to check the integrity of 230 kV paper-oil cables which have

been in service in Arizona for several years and of a 345 kV paper-oil cable system in New York. This x-ray system can also be used for on-line quality control in cable factories. (LCL)

51429 (ORNL/TM—6902) **High voltage research (breakdown strengths of gaseous and liquid insulators) and environmental effects of dielectric gases. Semiannual report, October 1, 1978—March 31, 1979.** Christophorou, L.G.; James, D.R.; Pai, R.Y.; Mathis, R.A.; Sauers, I.; Frees, L.; Pace, M.O.; Bouldin, D.W.; Chan, C.C.; Kent, E.J. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 177p. P 09/MF A01.

Progress in research on the breakdown strengths of gaseous dielectrics, on the environmental effects of gaseous dielectrics breakdown products, and on measurements of breakdown voltages of liquid n-hexane are reported. A short discussion of transmission losses in EHV AC gas-insulated and oil-filled cable transmission lines is included. (LCL)

51430 (SAN—1403-3) **Arc quenching in sulfur hexafluoride gas insulated structures. Quarterly report 3, December 16, 1977—March 15, 1978.** (Hughes Research Labs., Malibu, CA (USA)). Apr 1978. Contract EC-77-C-03-1403. 30p. P 03/MF A01.

The basic goal of this project is to develop an arc-quenching system (AQS) to protect SF_6-filled underground cable from permanent damage when the cable is subjected to an arc while in regular service. The concept being pursued is to develop an arc quencher with normally very high impendance that can be electrically located between the current-carrying conductor in the cable and ground. When an arc ocurs, the arc quencher switches rapidly to a low-impedance mode and either diverts or force-commutates the current from the arcing fault. If done quickly enough, this will permit the cable to recover its full dielectric capability. During the first nine months of the program, the nature of arcs in SF_6 was studied, a laboratory-model arc quencher was constructed and tested, the various possible arc quencher configurations were listed, and AQS studies both analytically and with a hybrid computer model were studied. The complex set of quantitative results have not yet yielded a design baseline that is considered sufficiently practical, reliable, and economical for use in a power system. These analyses will be continued through the next quarter.

NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 51635, 51789

51431 (DOE/TIC—10169) **UPDATE: Nuclear Power Program information and data.** (Department of Energy, Washington, DC (USA). Div. of Nuclear Power Development). May 1979. 106p. P 06/MF A01.

Statistical data on commercial nuclear power plant construction and operation in the US is presented.

51432 (IJS—106/5012-77) **Burn-up calculations in nuclear power plants.** Copic, M.; Ravnik, M.; Rant, J.; Khan, Q.; Slavic, S. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). 1977. 41p. (In Slovenian). U 06/MF A01.

For the burn-up calculations in power reactors a fast version of a multigroup diffusion code FASVER has been developed, characterized by an expandable square grid, the step of which can be adapted to the group diffusion length. The input data for FASVER are detained from the code RIBOT, received from NEA computer program library.

51433 (LA-UR—79-1879) **New instrument for the confirmation of declared power histories of central station nuclear power plants.** Dowdy, E.J.; Robba, A.A.; Hastings, R.D.; France, S.W. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 20p. (CONF-790707—27). P 02/MF A01.

From 20. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (16 Jul 1979).

An operationally simple, portable, microprocessor-based, unattended reactor power monitor was developed for International Atomic Energy Agency inspector use in confirming operator records of the power history of nuclear power plants. The monitor is based on the principle that the leakage neutron flux outside the biological shield is proportional to the thermal power level. The leakage flux is detected and compared with the leakage flux from the same reactor for a confirmed calibration period. Several output options are available, and a record of more than three months of hourly measurements of the themal power of the plant can be obtained. The monitor has battery backup power for interruptions of host power of duration up to 18 hours.

51434 (PNL—2906) **Nuclear knowledge and nuclear attitudes: is ignorance bliss.** Nealey, S.M.; Rankin, W.L. (Battelle Human Affairs Research Center, Seattle, WA (USA)). Oct 1978. Contract EW-78-C-06-1076. 97p. P 05/MF A01.

This executive summary highlights the major findings of a nuclear power mail-out survey administered to a random sample of Washington State residents, a random sample of residents (nuclear neighbors) from the region around the Hanford Reservation, and a random sample of members of a Washington State environmental interest group. The purpose of the research was threefold. The first was to determine from what sources people have received their information about nuclear power, from what sources they would like to receive additional information, and what kinds of additional information they would like to receive. A second purpose was to determine how much respondents already knew about nuclear power and nuclear waste disposal. The third purpose was to determine how one's knowledge about nuclear power was related to one's attitude about building more nuclear power plants. The findings are presented in summary form.

51435 (PNL—2995) **Comparative analysis of network television news coverage of nuclear power, coal, and solar stories.** Rankin, W.L.; Nearley, S.M. (Battelle Human Affairs Research Center, Seattle, WA (USA)). Feb 1979. Contract EW-78-C-06-1076. 56p. P 04/MF A01.

The purpose of this research was to analyze national television news coverage of nuclear power, coal power, and solar power issues to help gain an understanding about the information being presented about energy technologies that has been shaping public attitudes. ABC, CBS, and NBC news broadcasts from 1972 through 1977 were analyzed. A summary of the findings is presented.

51436 **Measuring the flow of condenser cooling water.** Vasiljevic, N. (Belgrade Univ. (Yugoslavia)). pp 175-193 of Mechanical engineering energetic. Proceedings of symposium papers. Beograd; Masinski fakultet Univerziteta u Beogradu (1977). (In Serbian)

From Symposium of mechanical engineering energetic; Beograd, Yugoslavia (1 Dec 1977).

For direct determination of heat losses in the condenser section of a turbogenerator unit it is necessary to measure the flow of cooling water. Measuring the cooling water flow also makes it possible to distribute it properly for low-pressure steam turbines with two or more flows, and to control heat losses in the condenser which even in large modern plants amount to about 57 per cent of the energy input. Solving the problem of measuring the cooling water flow contributes to more rational utilization of turbogenerator units.

51437 **Noise and fluids engineering.** Hickling, R. (ed.). New York, NY; American Society of Mechanical Engineers (1977). 252p. (CONF-771120—P7).

From Winter annual meeting of the American Society of Mechanical Engineers; Atlanta, GA, USA (27 Nov 1977).

A separate abstract is included for one of the papers presented concerning boiling detection methods for nuclear reactors.

POWER REACTORS, NON-BREEDING, LIGHT-WATER MODERATED, BOILING WATER COOLED

REFER ALSO TO CITATION(S) 51540, 51634, 51667, 51670, 51678, 51681, 51683, 51685, 51693, 51695, 51697, 51699, 51701, 51702, 51704, 51705, 51707, 51713, 51749

51438 (COO—4066-10) **Fuel Performance Improvement Program. Quarterly progress report, January—March 1979.** Crouthamel, C.E. (comp.). (Exxon Nuclear Co., Inc., Richland, WA (USA); Battelle Pacific Northwest Labs., Richland, WA (USA); Consumers Power Co., Jackson, MI (USA)). Apr 1979. Contract EY-76-C-06-1830. 89p. Dep. NTIS, PC A05/MF A01.

Progress in various tasks of the LWR Fuel Performance Improvement Program is summarized. These tasks include the testing and demonstration program, out-of-reactor experiments, in-reactor experiments, in-reactor demonstrations, and fuel performance evaluations.

51439 (LA—7914-MS) **Gamma doses from irradiated assemblies under water.** Rinard, P.M. (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG-36. 32p. P 03/MF A01.

The gamma doses in a small air-filled ionization chamber near an irradiated assembly under water have been calculated and compared to measurements of BWR and PWR assemblies. It was found that a line source parallel to an assembly's axis capped by disk sources could represent the assembly in the calculations. For those assemblies exposed to a longitudinally uniform neutron flux, the line source alone was sufficient even for points 30 cm beyond the end of the assemblies. For others that had experienced a stronger neutron flux in their central regions, the disk sources were very important contributors to the doses even 30 cm within the assemblies' ends.

The detectability of gaps in a fuel assembly was investigated by showing the changes in the dose profiles along an assembly with a variety of gaps.

51440 (NEDC—12691) **Characterization of the corrosion product films on the Dresden-1 pilot loop after re-exposure to reactor water.** Anstine, L.D.; Von Nieda, G.E. (General Electric Co., Pleasanton, CA (USA). Nuclear Technology Dept.). Oct 1977. Contract EY-76-C-02-4014. 89p. P 05/MF A01.

The chemical and physical properties of the corrosion product oxide films of four pipe and two coupon samples from the Dresden-1 pilot test loop have been measured. The samples represented stainless steel material that had been exposed to reactor water conditions before being chemically cleaned in June 1976 and material added after the loop was chemically cleaned. Twenty days of exposure to reactor water resulted in rapid buildup of radioactivity from the incorporation of high specific activity cobalt into the oxide films created by the corrosion of the stainless steel surfaces. The primary source of the cobalt radioactivity was the fuel deposits.

51441 (NUREG/CR—0838) **Stability analysis of circumferential cracks in reactor piping systems.** Tada, H.; Paris, P.; Gamble, R. (Washington Univ., St. Louis, MO (USA). Center for Fracture Mechanics). Jun 1979. 37p. C .

A simplified fracture mechanics analysis was performed to determine the potential unstable tearing in boiling water reaction (BWR) stainless steel piping that have severe intergranular stress corrosion cracking (IGSCC). The fracture analysis was based on the tearing stability concept and associated tearing modulus stability criterion. The results from this study indicate that unstable crack extension would probably not occur in BWR stainless steel piping systems designed in accordance with the ASME Code even though severe IGSCC may be present. The analysis indicated that stainless steel piping with severe IGSCC could experience unstable fracture if the piping length to radius ratio (L/R) was very large (approximately 200). Since the values of L/R for BWR stainless steel piping systems are generally an order of magnitude less than this, large margins against unstable fracture are assured for these systems.

51442 (SAND—79-0677C) **Physical protection of power reactors.** Darby, J.L. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 11p. (CONF-790707—6). P 02/MF A01.

From 20. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (16 Jul 1979).

Sandia Laboratories has applied a systematic approach to designing physical protection systems for nuclear facilities to commercial light-water reactor power plants. A number of candidate physical protection systems were developed and evaluated. Focus is placed on the design of access control subsystems at each of three plant layers: the protected area perimeter, building surfaces, and vital areas. Access control refers to barriers, detectors, and entry control devices and procedures used to keep unauthorized personnel and contraband out of the plant, and to control authorized entry into vital areas within the plant.

51443 **Automated procedure for selection of optimal refueling policies for light water reactors.** Lin, B.I. (Electric Power Research Inst., Palo Alto, CA); Zolotar, B.; Weisman, J. *Nucl. Technol.;* **44**: No. 2, 258-275(Jul 1979).

An automated procedure determining a minimum cost refueling policy has been developed for light water reactors. The procedure is an extension of the equilibrium core approach previously devised for pressurized water reactors (PWRs). Use of 1 1/2-group theory has improved the accuracy of the nuclear model and eliminated tedious fitting of albedos. A simple heuristic algorithm for locating a good starting policy has materially reduced PWR computing time. Inclusion of void effects and use of the Haling principle for axial flux calculations extended the nuclear model to boiling water reactors (BWRs). A good initial estimate of the refueling policy is obtained by recognizing that a nearly uniform distribution of reactivity provides low-power peaking. The initial estimate is improved upon by interchanging groups of four assemblies and is subsequently refined by interchanging individual assemblies. The method yields very favorable results, is simpler than previously proposed BWR fuel optimization schemes, and retains power cost as the objective function.

51444 **Fundamental technical features of equipment and materials in contemporary nuclear power stations.** Jovasevic, J.; StefanoVic, V.; Jovasevic, J. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). pp 231-238 of Mechanical engineering energetic. Proceedings of symposium papers. Beograd; Masinski Fakultet Univerziteta u Beogradu (1977). (In Serbian)

From Symposium of mechanical engineering energetic; Beograd, Yugoslavia (1 Dec 1977).

The paper gives a symmary of studies of fundamental technical parameters, systems and equipment used in commercially successful nuclear power stations which were completed at Boris Kidric Institute of Nuclear Sciences. A proposal for standard specification of basic materials for most important components of secondary circuit in PWR systems: steam aenerators, superheaters with separators, condensers and regeneration heat exchangers is given.

51445 **Towards an elastic-plastic fracture mechanics predictive capability for reactor piping.** Kanninen, M.F.; Sampath, S.G.; Broek, D.; Marschall, C.W.; McGuire, P.; Wilkowski, G.M. (Battelle Columbus Labs., OH (USA)). pp F8/1 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51446 **Structural analysis and incipient failure detection of primary circuit components based on correlation-analysis and finite-element models.** Olma, B.J. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)). pp F5/1 1-12 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

Vibration monitoring and loose parts monitoring during reactor operation take an essential part in an incipient failure detection system. Within this framework extensive measurements of mechanical vibrations of primary components have been accomplished at PWR, BWR and sodium cooled reactors. The application of correlation analysis methods (e.g. auto- and crosspower spectral density formalism) to these experiments leads to a steady-state representation within the frequency domain of the vibrative behaviour of the primary circuit components. A method is presented to compute vibrational power spectral densities (VPSD's) of primary circuit components based on a finite-element representation of the primary circuit. First this method has been applied to the sodium cooled reactor KNK, Karlsruhe. Now a further application is bing developed for a BWR-nuclear power plant.

51447 **Dynamic analysis of fuel elements in boiling water reactors.** Sasasi, Y.; Sasaki, Y.; Niwa, H. (Tokyo Shibaura Electric Co. Ltd., Kawasaki, Kanagawa (Japan). Research and Development Center). pp D4/7 1-10 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

Antiseismic design of Boiling Water Reactor core is one of the most important parts of BWR nuclear power plant design. It is very difficult to investigate the dynamic behavior of the reactor core, because the core consists of many fuel assemblies and is in water. The difficulty mainly depends upon the fact that the reactor core is not only considered as the multidegrees of freedom system, but also the interaction between the water and the fuel assemblies must be taken into consideration. Assuming the flow of the water is two-dimensional, the fluid force on the fuel assemblies is obtained by applying potential theory. The dynamic equations of the fuel assemblies are obtained by using these external hydraulic forces. In addition, results of tests on fuel assembly models are presented and compared with the above calculations.

51448 **Review of the acoustic detection of boiling in nuclear reactors.** Scarton, H.A. (Rensselaer Polytechnic Inst., Troy, NY); McDonald, J.F.; Carey, W.M. pp 109-123 of Noise and fluids engineering. Hickling, R. (ed.). New York, NY; American Society of Mechanical Engineers (1977).

From Winter annual meeting of the American Society of Mechanical Engineers; Atlanta, GA, USA (27 Nov 1977).

A review is presented of over 260 references on the physics of boiling, stressing acoustic monitoring techniques. Recent experimental results are examined for sodium boiling during LMFBR excursions and the characteristics of the physical acoustic signatures are identified.

POWER REACTORS, NON-BREEDING, LIGHT-WATER MODERATED, NON-BOILING WATER COOLED

REFER ALSO TO CITATION(S) 51438, 51439, 51442, 51443, 51444, 51446, 51448, 51540, 51631, 51646, 51659, 51670, 51678, 51679, 51683, 51686, 51687, 51692, 51694, 51695, 51698, 51699, 51701, 51702, 51704, 51705, 51710, 51711, 51712, 51716, 51739, 51741, 51742

51449 (BMFT-FB-K—78-09) **Investigations of steam separators for pressurized water reactor steam generators.** Schuecktanz, G.; Nieschler, W. (Bundesministerium fuer Forschung und Technologie,

Bonn-Bad Godesberg (Germany, F.R.)). Oct 1978. 64p. (In German). U 04/MF A01.

Within the scope of this task, experimental investigations of steam separators (perforated baffles, impingement separators, cyclons) as well as measurements on one specially instrumented steam generator of Stade at normal power conditions and at elevated steam pressure have been carried out. The results showed that simple separation systems (perforated baffles to obtain a quiescent two-phase-inter-phase, impingement separators, and wire-mesh dryers) are not suitable for steam loading of about 100 t/m^3h in steam generators.

51450 (CONF-790655—5) **Drag devices for two-phase mass flow measurements.** Anderson, J.L. (Idaho National Engineering Lab., Idaho Falls (USA)). 1979. Contract EY-76-C-07-1570. 63p. P 04/MF A01.

From Colloquium on two-phase instrumentation; Idaho Falls, ID, USA (11 Jun 1979).

Results are presented from testing a number of full flow drag devices in steady state air—water mixtures, transient steam—water mixtures, and Semiscale Mod-3 Test S-07-8 for obtaining two-phase mass flow measurements. Modeling methods for obtaining mass flow rates are discussed along with the effects of two-phase flows on the drag coefficient of full flow multihole drag plates.

51451 (EUR—5650) **Ardennes nuclear power plant. Annual report 1975.** (Commission of the European Communities, Luxembourg). May 1977. 36p. (In French). U 03/MF A01.

At the beginning of the year 1975 the nominal power of the nuclear plant of the Ardennes was brought from 950 up to 1040 MW(t), after a positive decision of the official safety organizations. Net energy produced: 2016 GWh, number of coupled hours: 6832 h, coefficient of availability: 75%, total number of standstills: 25. The functioning of the installations is, on the whole, very satisfying. Liquid wastes are clearly inferior to admissible maximum limits. The cost per KWh of the plant amounts to 5.57 French centimes. For the last 5 years net production has reached 9375 GWh, which means an average coefficient of availability of 76.7%.

51452 (HEDL—6585) **Electrical connectors for nuclear service: test program results.** Stringer, J.L.; Sheen, E.M. (Hanford Engineering Development Lab., Richland, WA (USA)). Jun 1979. Contract EY-76-C-14-2170. 20p. P 02/MF A01.

Two types of electrical connectors, designed and fabricated at PNL, were tested by HEDL under conditions simulating severe external environments of the intended test reactor service. One connector was designed to connect 3 to 4 stainless sheathed two conductor cables in a PWR environment (650°F, 2500 psig). The second connector was designed to connect several (10 to 20) metal sheathed cables outside the PWR environment to a flexible cable. The testing performed on the connector was designed to allow determining the amounts of interfering signal added to the sensor circuit by the addition of a connector. These tests included ac coupling into dc circuits, ac coupling with other ac circuits and dc coupling into other dc circuits. These tests were carried out both at room ambient and at 650°F in the laboratory and autoclave for the high pressure, high temperature connector and only in the laboratory for the low pressure/temperature connectors. The results of these test are described.

51453 (HEDL-SA—1684) **Neutron emission observed from spent thermal reactor fuel assemblies.** Gold, R.; Ruddy, F.H.; Lippincott, E.P.; McElroy, W.N.; Roberts, J.H. (Hanford Engineering Development Lab., Richland, WA (USA)). 6 Nov 1978. Contract EY-76-C-14-2170. 5p. (CONF-790430—16). P 02/MF A01.

From 1. annual symposium on safeguards and nuclear material management; Brussels, Belgium (25 Apr 1979).

A scoping experiment to characterize the neutron field generated from a Light Water Reactor spent fuel assembly has been successfully completed. Solid State Track Recorder (SSTR) neutron dosimeters have been exposed at the surface of a spent fuel assembly from a Pressurized Water Reactor. Acceptable track densities were obtained. From these SSTR neutron dosimetry observations, an absolute neutron flux of roughly 8000 $n/(cm^2.sec)$ was obtained at the surface of the spent fuel assembly three years after discharge. The deduced neutron energy spectrum, with a mean neutron energy of roughly 1.3 MeV, is intimately dependent upon the actinide content of the spent fuel. Hence, the results of this preliminary experiment have demonstrated that, with suitable calibration, SSTR neutron dosimetry can be successfully applied for non-destructive spent fuel actinide assay and for characterization of the radiation environment associated with spent reactor fuel assemblies.

51454 (KFKI—1977-108) **Experimental high pressure water loops Pt. 1. General description.** Szabados, L.; Beszeda, T.; Csom, V.; Maroti, L.; Windberg, P. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Jan 1978. 35p. (In Hungarian). U 03/MF A01.

The loop was erected for the investigation of thermohydraulic processes in water-cooled power reactors. The main parameters of the loop and the constructional details of the different units as well as their role are described. The present status with six parallel test sections for different experiments is presented. The layout of the test sections in use and their constructional details are shown in some examples.

51455 (KFKI—1977-115) **Steady state and transient critical heat flux examinations.** Szabados, L. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Feb 1978. 39p. (In Hungarian). U 03/MF A01.

In steady state conditions within the P.W.R. parameter range the critical heat flux correlations based on local parameters reproduce the experimental data with less deviations than those based on system parameters. The transient experiments were restricted for the case of power transients. A data processing method for critical heat flux measurements has been developed and the applicability of quasi steady state calculation has been verified.

51456 (ORNL/TM—6804) **Study of the Cherokee Nuclear Station: projected impacts, monitoring plan, and mitigation options for Cherokee County, South Carolina.** Peelle, E.; Schweitzer, M.; Scharre, P.; Pressman, B. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 187p. P 09/MF A01.

This report inventories Cherokee County's capabilities and CNS project characteristics, projects expected impacts from the interaction of the two defines four options for Cherokee County decision makers, and presents a range of possible mitigation and monitoring plans for dealing with the problems identified. The four options and general implementation guidelines for each are presented after reviewing pertinent features of other mitigation and monitoring plans. The four options include (1) no action, (2) preventing impacts by preventing growth, (3) selective growth in designated areas as services can be supplied, and (4) maximum growth designed to attract as many in-movers as possible through a major program of capital investiments in public and private services. With the exception of the no action option, all plans deal with impacts according to some strategy determined by how the County wishes to manage growth. Solutions for impact problems depend on which growth strategy is selected and what additional resources are secured during the impact period. A monitoring program deals with the problems of data and projections uncertainty, while direct action is proposed to deal with the institutional problems of delay of the needed access road, timeing and location problems from the tax base mismatch, and lack of local planning capability.

51457 (TGL—32070/03) **Valves and fittings for nuclear power stations. Testing.** (VEB Magdeburger Armaturenwerke 'Karl Marx' (German Democratic Republic)). 30 Jul 1976. 8p. (In German). U 02/MF A01.

The standard specifies methods to be applied in the testing of valves and fittings for nuclear power stations with PWR type reactors. It includes leak and pressure resistance testing, examination of the surface quality, of materials by chemical and physical methods, of paints and of the functioning.

51458 **Chemical cleaning of PWR steam generators to relieve denting.** Pettit, P.J.; McTigue, P.F. (US DOE, Washington, DC). *Mater. Performance;* **17**: No. 10, 36-41(Oct 1978).

The cleaning problem involves removal of accumulated sludge and compacted magnetite in crevices between carbon steel supports and tubes. The program calls for: (1) pilot plant tests of combinations of weak organic acids and chelants in various cleaning and passivating schedules to identify the best method, (2) training of personnel to handle radioactive waste from the cleaning operation, and (3) analysis of possible vibration effects when deposits removed from tube plate holes leave enlarged holes.

51459 (WAPD-TM—1371) **Fuel utilization potential in light water reactors with once-through fuel irradiation (AWBA Development Program).** Rampolla, D.S.; Conley, G.H.; Candelore, N.R.; Cowell, G.K.; Estes, G.P.; Flanery, B.K.; Duncombe, E.; Dunyak, J.; Satterwhite, D.G. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Jul 1979. Contract EY-76-C-11-0014. 162p. P 08/MF A01.

Current commercial light water reactor cores operate without recylce of fuel, on a once-through fuel cycle. To help conserve the limited nuclear fuel resources, there is interest in increasing the energy yield and, hence, fuel utilization from once-through fuel irradiation. This report evaluates the potential increase in fuel utilization of light water reactor cores operating on a once-through cycle assuming 0.2% enrichment plant tails assay. This evaluation is based on a large number of survey calculations using techniques which were verified by more detailed calculations of several core concepts. It is concluded that the maximum fuel utilization which could be achieved by practical once-through pressurized light water reactor cores with either uranium or thorium is about 17 MWYth/ST U_3O_8 (Megawatt Years Thermal per Short Ton of U_3O_8). This is about 50% higher than that of current commercial light water reactor cores. Achievement of this increased fuel utilization would require average fuel burnup beyond 50,000 MWD/MT and incorporation of the following design features to reduce parasitic losses of neutrons:

reflector blankets to utilize neutrons that would otherwise leak out of the core; fuel management practices in which a smaller fraction of the core is replaced at each refueling; and neutron economic reactivity control, such as movable fuel control rather than soluble boron control. For a hypothetical situation in which all neutron leakage and parasitic losses are eliminated and fuel depletion is not limited by design considerations, a maximum fuel utilization of about 20 MWYth/ST U_3O_8 is calculated for either uranium or thorium. It is concluded that fuel utilization for comparable reactor designs is better with uranium fuel than with thorium fuel for average fuel depletions of 30,000 to 35,000 MWD/MT which are characteristic of present light water reactor cores.

51460 Improved water density feedback model for pressurized water reactors. Casadei, A.L. (Rensselaer Polytechnic Inst., Troy, NY); Turinsky, P.J. *Nucl. Technol.;* **44**: No. 2, 221-230(Jul 1979).

Accurate and economical methods have been developed to model water density feedback in diffusion calculations for applicaton to pressurized water reactors. Spectral variations of the two-group macroscopic cross sections are accurately modeled by second-order polynomials in water density. Open channel and subcooled boiling effects on the core's water density distribution are evaluated by coupling three-dimensional thermal-hydraulic and neutron diffusion computer codes. The costly requirement of numerical mesh compatibility between these codes is removed without loss of accuracy. The margin to fuel degradation limits during accident conditions is found to increase when the improved feedback model is employed, serving as a stimulus for further usage.

51461 Development of an advanced method for fuel seismic analysis. Nuno, H.; Mizuta, M.; Tsumura, N. (Mitsubishi Atomic Power Industries, Inc., Omiya, Saitama (Japan). Engineering and Development Div.). pp 4/6 1-13 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The method of seismic vibration analysis of PWR fuel (FUVIAN2) has been reported previously. The method has further been developed later (FUVIAN3) with special concern with grid impact model, because it still had a problem of predicting too conservative grid impact force although displacement prediction was very appropriate. In addition, another computor code FLOAN (Fuel Local Stress Analysis) was developed so that the authors could analyse internal stresses in the fuel assembly under seismic vibration. This paper explains briefly about the procedures of fuel seismic evaluation in which the combined FUVIAN and FLOAN methods are applied and then explains about the details of analytical methods of both codes together with various verification tests for them.

51462 Propagation of inadequate joint penetration defects of welded elbows. Doyen, J.J.; Marini, J. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Courbevoie (France)). pp F1/3 1-11 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

Auxilliary piping elbows of PWR reactors are assembled by longitudinal submerged arc weld of two halves. The elbows are made of ICL 167 CN similar to AISI 316. During fabrication and erection on site some of them have been cut and repaired because of lack of penetration, causing important costs and delays. The studies performed and presented here were conducted in order to evaluate the possible serious consequences of this defect and allow predicting for the future in case of existence of such defect in a weld: how it will cause a crack propagation and how it will be possible to detect and measure it from the outside. Tests have been performed on fatigue specimens cut in the weld of an elbow (with real defect, and with artificial machined crack) in air and PWR environment.

51463 Experimental model parameters for pipe whip. Palusamy, S.; Cloud, R.L.; Campbell, T.E. (Westinghouse Electric Corp., Pittsburgh, PA (USA). PWR Systems Div.). pp F2/4 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51464 Inelastic analysis of finite length and depth cracked tubes. Reich, M.; Gardner, D.; Prachuktam, S. (Brookhaven National Lab., Upton, NY (USA)); Chang, T.Y. (Akron Univ., OH (USA). Dept. of Civil Engineering). pp F7/4 1-10 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

Steam generator tube failure can at times result in reactor safety problems and subsequent premature reactor shutdown. This paper concerns itself with the prediction of the failure pressures for typical PWR steam generator tubes with longitudinal finite length and finite depth cracks. Only local plastic overload failure is considered since the material is non-notch sensitive. Non-linear finite element analyses are carried out to determine the burst pressures of steam generator tubes containing longitudinal cracks located on the outer surface of the tubes. The non-linearities considered herein include elastic-plastic material behaviour and large deformations. A non-proprietary general purpose non-linear finite element program, NFAP was adopted for the analysis. Due to the asymmetric nature of the cracks, two-dimensional as well as three-dimensional finite element analyses, were performed. The analysis clearly shows that for short cracks axial effects play a significant role. For long cracks, they are not important since two-dimensional conditions predominate and failure is governed by circumferential or hoop stress conditions.

51465 Damping of reactor internals. Singleton, N.R.; Bohm, G.J. (Westinghouse Electric Corp., Pittsburgh, PA (USA). PWR Systems Div.). pp F5/4 1-10 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

During normal operation, reactor internals are excited by random and deterministic forcing functions. The complex fluid elastic system formed by the internals structures and reactor coolant responds in numerous modes and depends on the modal damping coefficients. This paper presents and discusses the results of a study of internals damping using data obtained from wave analysis of PWR plant flow tests, and shaker tests. The paper discusses the application of the data to component design. Damping values reported are suitable for normal operation design conditions, i.e. for oscillatory behaviour and relatively small amplitudes. The extrapolation of the data to obtain realistic values for large seismic events and for loss of coolant accidents is also discussed briefly considering that for these faulted conditions, the amplitude of the response is much larger than for normal operation.

51466 Synthesis of vibration studies on a three loop PWR internals model. Assedo, R. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Courbevoie (France)); Epstein, A.; Gibert, R.J.; Livolant, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. des Etudes Mecaniques et Thermiques). pp F5/3 1-7 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The flow induced vibrations problems are of complex nature. While it is easy to measure the global effects on the structures, it is often difficult to understand the phenomena mechanisms, because the various excitation sources, cause of the structures motion, do not act separately, but in a combined way. In the case of reactor internal structures, the authors have carried out a relatively complete study, based on a three loop PWR 1/8 internals model, the SAFRAN test model. Methods and specific means of calculation were associated in this experimental tool, allowing thus the understanding of the phenomena and their extrapolation to the full scale reactor. Experimental tests in air, and in still water were carried out, to determine structures frequencies, mode shapes and generalized coefficients. Flow tests were made to measure the random response of internal structures, and to get information about the fluctuating pressure field acting on the system.

51467 New high temperature deformation model for Zircaloy clad ballooning under hypothetical LOCA conditions. Brzoska, B.; Cheliotis, G.; Kunick, A.; Senski, G. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). pp C1/8 1-12 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

Assuming Zircaloy clad ballooning occurs predominantly by thermal activated secondary creep, generally a power law is applied to describe the creep rate analytically. According to Norton the creep rate is taken as a power function of the cladding hoop stress multiplied by a numerical constant which is determined by the cladding structural properties and a Boltzmann factor including the creep activation energy, the gas constant and the cladding temperature, respectively. As is well known, the stress exponent is not a constant value in the total range of LOCA stresses, but increases steadily with stress. This difficulty is avoided by introducing into the Norton law a plastic flow-factor including a limiting stress, which was derived by G. Senski using plastic crack models from Dugdale and Irwin. For LOCA applications the limiting stress is identified with the burst stress, which is experimentally determined. A total

number of about 290 directly heated KWU burst tests including two types of experiments: (1) controlled temperature transient tests, (ii) creep rupture tests, are used to fit the burst stress of KWU Zircaloy tubes simulating the whole range of LOCA temperatures, heating rates and creep times.

51468 Crack growth rate analysis in PWR reactor piping. Doyen, J.J. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Courbevoie (France)); Lebey, M.; Vrillon, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. des Etudes Mecaniques et Thermiques). pp F 7/6 1-15 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The survey of crack growth on PWR reactor primary circuit pipings is the subject matter of the Aquitaine-1 Program. - This program includes an experimental part on piping elements made of stainless steel AISI 316, L scale 1/4 of primary pipings. These pipings are subject to cyclic variations of cold pressure, then to 290°C in water, utilizing a specific test loop. At 290°C the pressure variations are between the atmosphere and 160 bars at 4 cycles/hr. With the above conditions the experimental part constitutes a realistic approach to phenomena pertaining to defects propagation in actual operating conditions. A first phase consisted of characterizing the material. The speed of cracking was determined on test-piece CT in the various environment conditions: air 20°C, air 320°C, water 320°C. Furthermore, an evaluation of the influence of the cycling frequency on that speed had been made.

51469 Nonlinear load deflection characteristics of a reactor fuel bundle. Fisher, H.D. (Combustion Engineering, Inc., Windsor, CT (USA)). pp D2/8 1-12 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

Employing a lucid free body diagram of a bundle segment, the present study demonstrates that for bundles consisting of two tube types (the typical application in the nuclear industry) a physically realistic model for the calculation of static deformation is described by a system of N equations in N unknown where N equals 12 rather than 16 as in Barinka's work. In addition to correcting Barinka's analysis and indicating restrictions inherent in first order theory, this study extends the previous formulation to symmetrically loaded fuel bundles restained by rotational springs with spring modulus K(K=0 is the case investigated by Barinka i.e. pinned ends). Employing an iterative technique similar to a procedure derived by Halliday and Horvay, numerical results are obtained which demonstrate that the end moments required to produce a specified end fixity cannot be determined from elementary beam theory.

51470 Sensitivity of fuel performance code analysis to design and property assumption. Heckermann, H. (Stoller (S.M.) Corp., New York (USA)); Hoppe, N. (Societe Belge pour l'Industrie Nucleaire, Brussels). pp C2/8 1-13 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The code COMETHE III-J was used to demonstrate the sensitivity of fuel performance codes to input properties, assumed models and small changes in design parameters. For this study the Maine Yankee Core 1 rods were chosen, because of the unexpected phenomenon which was observed during a very complete PIE of these rods. The examination showed, that a group of almost identical rods, which underwent similar power history could be separated into two populations of fractional gas release (less than 1% and 11.3 to 13.5%). Low gas release rods showed no fuel restructuring whereas the high gas release rods showed equiaxed grain growth in the fuel along almost the total fuel column. The rods with extended equiaxed grain growth and the high fractional fission gas release rates could be simulated by the COMETHE code, using the actual power history and fuel pin design data. The fuel centerline temperature of this case showed the unexpected trends. Axial segments with lower axial peaking factors showed higher central fuel temperatures than segments with higher axial peaking factors for end of like condition. The normally expected ralationship between power and temperature existed at BOL. The reversed trends of the fuel centerline temperatures were caused by a combination of gap closure, fission gas release behavior and relocation due to fission gas bubble swelling.

POWER REACTORS, NON-BREEDING, GRAPHITE MODERATED

REFER ALSO TO CITATION(S) 51542, 51700, 51704, 51966

51471 (CEGB-RD/B/N—4238) **New approach to the calculation of axial and radial neutron diffusion coefficients.** Hughes, R.P. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1978. 18p. U 02/MF A01.

A new approach to the calculation of axial and radial diffusion coefficients is developed that introduces a new angle dependent 'transport cross-section'. Calculations are carried out using the programme WDSN(ST) for both AGR-type and SGHWR lattices. The results are compared with the standard method due to Benoist embodied in WIMS and, in the AGR case, with Monte Carlo results. The comparisons suggest major errors in the WIMS results for SGHWR clusters in the axial direction.

51472 (COO—2712-6) **Studies of mechanical properties and irradiation damage nucleation of HTGR graphites. Progress report, February 1, 1978—March 31, 1979.** Thrower, P.A. (Pennsylvania State Univ., University Park (USA)). Apr 1979. Contract EY-76-S-02-2712. 18p. P 02/MF A01.

Irradiation damage effects to highly oriented pyrolytic graphite by 1.5, 5.5 and 15 MeV neutrons are briefly described. Studies of the effects of oxidation on the structure and strength of Stackpole 2020, Great Lakes H440 and POCO AXF-5Q graphites have been continued using H_2O vapor as the oxidant. The effect of burn-off on compressive strength is similar to that of CO_2, but structural effects are quite different. The kinetics of the C—CO_2 reaction are being studied using low CO_2 partial pressures in a total pressure of one atmosphere. The necessary modifications to existing apparatus have been made and experimental work is commencing.

51473 (EUR—5463) **Second Euratom sponsored 900°C HTR fuel irradiation experiment in the HFR Petten Project E 96.02: Pt.2. Post-irradiation examination.** Roettger, R.; de Bueger, J.; Schoots, T. (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center). 1977. 156p. U 08/MF A01.

A large variety of HTR fuel specimens, loose coated particles, coupons and compacts provided by Belgonucleaire, the Dragon Project and the KFA Juelich have been irradiated in the HFR at Petten at about 900°C up to a maximum fast neutron fluence of about $7x10^{21}cm^{-2}$ (EDN) as a Euratom sponsored experiment. The maximum burn-ups were between 11 and 18.5% FIMA. The results of the post-irradiation examinations, comprising visual inspection, dimensional measurements, microradiography, metallography, and burn-up determinations are presented in this part 2 of the final report. The examinations have shown that the endurance limit of most of the tested fuel varieties is beyond the reached irradiation values.

51474 (EUR—5841) **Post-irradiation examination of a 1300°C-HTR fuel experiment Project J 96.M3.** de Bueger, J.; Roettger, H. (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center). 1977. 134p. U 07/MF A01.

A large variety of loose coated fuel particles have been irradiated in the BR2 at Mol/Belgium at temperatures between 1200°C and 1400°C and up to a fast neutron fluence of 1.2x1022 cm^{-2} (E>0.1 MeV) as a Euratom sponsored experiment for the advanced testing of HTR fuel. The specimens have been provided by Belgonucleaire and the Dragon Project. A short description of the experiment as well as the results of post-irradiation examination mainly carried out at Petten (N.H.), The Netherlands, are presented. The post-irradiation examination has shown that the required performance can be achieved by a number of the tested fuel specimens without serious damage.

51475 (GA-A—15002) **Gas turbine HTGR program. Quarterly progress report for period ending March 31, 1978.** (General Atomic Co., San Diego, CA (USA)). Jun 1979. Contract EY-76-C-03-0167-046. 100p. P 05/MF A01.

This report describes work performed on the direct cycle high-temperature gas-cooled reactor (DC-HTGR) program, Department of Energy Contract EY-76-C-03-0167, Project Agreement No. 46, during the period January 1, 1978, through March 31, 1978. The report covers the demonstration plant design studies, heat exchanger design studies, structural engineering studies, auxiliary system design, system engineering analysis, and reactor core engineering.

51476 (GA-A—15148) **MINT computer program for numerical computation of turbulent flow: an overview.** Burton, T.E. (General Atomic Co., San Diego, CA (USA)). May 1979. Contract EY-76-C-03-0167-017. 44p. P 03/MF A01.

The need to calculate turbulent recirculating flow fields in two or three dimensions arises frequently at General Atomic Company (GA). The MINT finite difference code, recently purchased from Scientific Research Associates (Glastonbury, Connecticut), can often

meet this need. In its present form the code solves the full Navier—Stokes momentum transport equations, the mass and energy transport equations, and two additional transport equations which model turbulence. MINT efficiently handles turbulent wall layers and implements most standard boundary conditions with a minimum of user effort. Flow geometries must be simple. Each boundary surface must coincide with a grid point surface, and no reentrant corners are permitted. A program to overcome this latter deficiency is underway.

51477 (GA-A—15329) **Core support block thermal mixing test analysis report.** Chin, E. (General Atomic Co., San Diego, CA (USA)). May 1979. Contract EY-76-C-03-0167-061. 103p. P 06/MF A01.

The extent of gas mixing and pressure drop within the core support block was experimentally investigated for various geometric and height configurations. These tests were conducted by the Experimental Engineering Branch of General Atomic Company. As a result of this investigation, the core support block thermal mixing and pressure drop has been quantified. Thermal mixing and the temperature sensor accuracy can be substantially improved at the cost of higher pressure drop. A 70-degree miter angle configuration is recommended for the reference design of the HTGR core support block (CSB). The recommended CSB height will depend on further evaluation of the possible range of variations in fuel region reactor conditions to be determmined by the Systems Engineering Department. The average temperature in a rodded region (a region with control rods in the lowered position) can be measured by the temperature sensor to within a 45°F accuracy, a big improvement from an early CSB design tested by the Commissariat a La Energie Atomique at Saclay, France in 1974 and 1975.

51478 (GA-A—15349) **Factors affecting the performances of sprayed chromium carbide coatings for gas-cooled reactor heat exchangers.** Lai, G.Y. (General Atomic Co., San Diego, CA (USA)). Mar 1979. Contract EY-76-C-03-0167-050;EY-76-C-03-0167-065. 35p. (CONF-790442—18). P 03/MF A01.

From International conference on metallurgical coatings; San Diego, CA, USA (23 Apr 1979).

The paper discusses some important factors to be considered for using sprayed coatings in gas-cooled reactor heat exchangers. These factors include (a) high-temperature gaseous corresion, (b) thermal stability of coatings, (c) metallurgical compatibility between the coating and substrate, and (d) effects of the coating on the mechanical properties of the substrate alloy. The coatings evaluated were Cr_3C_2—NiCr and $Cr_{23}C_6$—NiCr applied by either piasma-arc or detonation-gun process.

51479 (GA-A—15377) **Use of spikants in HTGR fuel and their effect on costs.** Brooks, L.H. (General Atomic Co., San Diego, CA (USA)). May 1979. Contract EY-76-C-03-0167-017. 30p. P 03/MF A01.

The costs of fresh fuel fabrication have been estimated for flowsheets that have spikant added (Co-60) at various points. The costs are compared with refabricated and fresh fuel fabrication costs. It is shown that the costs increase as the spikant is added nearer to the plant feed point. The least cost is achieved by adding a detachable spikant to the finished fuel element. The highest cost is incurred when the spikant is fed in with the plant feed. This cost is greater than that for refabricated fuel because extra process cells are necessary to prepare the spikant and, in addition, the gamma flux from the Co-60 is much greater than from U-232 and greater precautions have to be taken.

51480 (IAE—2845) **r,phi,z - geometry calculation of temperature fields in porous media with spatial nonuniformity of heat release.** Segal', M.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1977. 10p. (In Russian). U 02/MF A01.

The r,phi,z geometry calculation technique of temperature fields in case of gas flowing in homogenizing medium with spatial nonuniformity of heat release, characterized by volume porosity and hydraulic diameter is considered. The AVR reactor output temperature field is calculated as an example. The reactor has the core of the 3m diameter consisting of spherical charging approximately 10^5 spheres of the 60 mm diameter). According to the estimation the coefficient of the heat release nonuniformity is equal to 1.25. It is found that the temperature field formation is affected by the initial nonuniformity of the heat release and besides that by two processes: mixing and overheating of hot cells due to the nonuniformity of consumption. The results show a relatively weak effect of mixing processes due to small quantities of consumption intensity in the given type of apparatuses. The given techniqUe can be used for calculating temperature fields in any homogenizing medium, if the quantities of hydraulic resistance, heat transfer and effective transfer coefficients are known.

51481 (JAERI-M—7728) **Overview of Japanese seismic research program for HTR.** Ikushima, T. (Japan Atomic Energy Research Inst., Tokyo). Jul 1978. 28p. U 03/MF A01.

In order to obtain the license for construction and operation of HTR developed and introduced into Japan, it is necessary to assure integrity of reactor structures and the capability of reactor shutdown and maintain safety shutdown for the seismic design condition. Because Japanese land is located in relatively high seismacity zone, when an excessive earthquake would occur, the public and plant personnel should be protected from radiation hazard. For the above reason, many efforts of seismic research and development for HTR have been made at institutes and companies in Japan. In the paper, descriptions are: (1) Present status of development and construction plans of HTR, (2) guideline of aseismic design, (3) need of aseismic research, (4) present status of research and development, (5) future plan.

51482 (ORNL—5536) **Gas-cooled reactor programs: High-Temperature Gas-cooled Reactor Base-Technology Program. Annual progress report for period ending December 31, 1978.** Homan, F.J.; Kasten, P.R. (Oak Ridge National Lab., TN (USA)). Jun 1979. Contract W-7405-ENG-26. 246p. Dep. NTIS, PC A11/MF A01.

Progress in HTGR studies is reported in the following areas: fission product transport and coolant impurity effects, fueled graphite development, PCRV development, structural materials, characterization and standardization of graphite, and evaluation of the pebble-bed type HTGR.

51483 (ORNL/SUB—76250/2) **Helium circulators. Phase 2. Performance test report.** Dominy, D.G. (Mechanical Technology, Inc., Latham, NY (USA)). Apr 1979. Contract W-7405-ENG-26. 315p. P 14/MF A01.

Data from the performance testing and 100-hour shakedown testing of a prototype helium circulator and electric motor are presented. (JWR)

51484 **Transverse flow in high-temperature gas-cooled reactor graphite elements.** Mysels, K.J. (General Atomic Co., San Diego, CA). *Nucl. Technol.;* **44**: No. 2, 203-209(Jul 1979).

In a high-temperature gas-cooled reactor, there is a narrow gap between the fuel stick and the graphite septum separating it from the rapidly flowing helium coolant. Porosity of the graphite permits a small part of the helium to flow through the gap. This parasitic transverse flow may be significant in fission product transport. The extent and pattern of this flow is calculated in terms of the resistivities to gas flow: axially for the gap and radially for the septum. The latter was measured for a number of Fort St. Vrain elements, and the former was obtained from specifications. The calculated flow in a fuel hole amounts to a fraction of 1 cm^3/s on the average and may reach slightly over 1 cm^3/s.

51485 **Factors affecting defective fraction of Biso-coated high-temperature gas-cooled reactor fuel particles during in-block carbonization.** Caputo, A.J.; Johnson, D.R.; Bayne, C.K. (Oak Ridge National Lab., TN). *Nucl. Technol.;* **44**: No. 2, 276-283(Jul 1979).

It was demonstrated that the in-block carbonization process step of high-temperature gas-cooled reactor (HTGR) fuel element refabrication can produce acceptable HTGR fuel rods with respect to the performance of Biso-coated thoria fuel particles. The rods had the desired pitch—coke yield (30 +- 5%), and the defective fraction of fuel particles was below the desired maximum limit of 1×10^{-4}. The pitch—coke yield was controlled by the heating rate of the carbonization cycle, and the defective fraction of fuel particles was controlled by both the heating rate of the carbonization cycle and the particle crushing strength. The heating rate and the particle crushinng strength can vary considerably, and the process will still produce an acceptable product.

POWER REACTORS, NON-BREEDING, OTHERWISE MODERATED OR UNMODERATED

REFER ALSO TO CITATION(S) 51540

51486 **Assessment of basic approaches to the design of loop type LMCRs.** Amorosi, A.; Ahmed, H.; Seidensticker, R. (Argonne National Lab., IL (USA)); Weltmer, W.W. pp 261-268 of Optimization of sodium-cooled fast reactors. London; Thomas Telford for the British Nuclear Energy Society (1978).

From BNES conference on optimization of sodium cooled fast reactors; London, UK (28 Nov 1977).

The best liquid metal cooled type primary system design may be strongly dependent on national and site requirements. As an example, the degree of periodic pipe inspection and the seismic design conditions required could greatly affect the acceptability of a standard insulated and lagged pipe approach. The coiled pipe type system looks more attractive than a standard horizontal or vertical elbow type system. Primary systems which should be further consid-

ered are coiled and free-end pipe systems, particularly with dry and wet satellite tanks. It is difficult to design a hot-leg pump for thermal transients and elevated temperature. The hot-leg pump also results in a number of other undesirable plant features. If a low pressure drop reactor outlet pipe and a low pressure drop IHX can be developed it would be possible to use the more desirable cold-leg pump. For commercial--size plants there are many advantages to a large reactor vessel (12-14m diameter). Although design and field fabrication of these large vessels appears feasible, a comparative study of the design and fabrication of both large field fabricated vessels and shop fabricated vessels would be of considerable value.

51487 Hydrodynamic mass and fluid damping of rod bundles vibrating in confined water and air-water mixtures. Carlucci, L.N. (Westinghouse Canada Ltd., Hamilton, Ontario. Atomic Power Div.). pp D3/11 1-10 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

In the past few years, a considerable effort has been developed to increasing the understanding of fuel string vibration mechanisms in CANDU (Canadian Deuterium Uranium) reactor channels. Part of the overall program has involved the development of a mathematical model which describes fuel string dynamics in axial flow. Because of the complex bundle geometry, model input parameters such as bundle hydrodynamic mass and associated fluid damping are difficult to determine from theory, and recourse is made to experimental techniques. This paper presents the results of an experimental study conducted to determine these parameters. Assembles of three types of 0.5m long CANDU bundles (with fuel pellets removed to reduce weight), each comprised of two bundles clamped end to end on a central support rod, were tested in flow channels of various inside diameters. An electrodynamic shaker, mounted directly on the flow channel, was used to sinusoidally excite the assembly at its mid-point. A large number of tests was carried out with flow channels filled with air, water, and a range of air-water mixtures (0% to 30% air volume fraction).

51488 Mechanical design considerations for a collapsible fuel cladding. Das, M.; Rustagi, R.S. (Department of Atomic Energy, Bombay (India). Power Projects Engineering Div.). pp C3/11 1-8 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The design of fuel elements for the pressurised heavy water reactors being built in India is based on thin zircaloy cladding of collapsible type dictated by the use of natural uranium dioxide fuel material. In order to establish reliable design criteria for satisfactory performance during the life time, a thorough understanding of the behaviour of such fuel elements is necessary. In this paper, the following problems related to structural stability associated with the use of thin-walled cladding are examined. (i) Longitudinal Ridge Formation: The dominant collapsed mode for the cladding tube is found to be an oval with a single lobe in the transverse section, the shape depending on the diametral clearance between the pellet and the sheath. (ii) Circumferential Ridge Formation: Circumferential ridging at pellet interfaces commonly observed in irradiated fuel, have been analysed on the basis of hourglass shape by Veeder, AECL-2660 (1967). In the present model, however, it is predicted that circumferential ridging could form even in the absence of a temperature gradient, as is observed during out-of-pile autoclave tests. (iii) Collapse into Axial Gaps: Collapse into axial gaps between adjacent pellets or between pellets and end-plugs is also analysed. Calculations by classical formulae indicate that the critical pressure is overestimated by a factor of about 2.5.

51489 Computerised channel temperature monitoring system. Kumar, D.; Raghavendra Rao, B.; Ramana Rao, A.; Bhaskara Rao, G. (Electronics Corp. of India, Hyderabad). pp 116-120 of Nuclear reactor instrumentation. Vol. I. Bombay; Department of Atomic Energy (1976).

From Symposium on nuclear reactor instrumentation; Bombay, India (20 Dec 1976).

The computerised channel temperature monitoring system for the Rajasthan Atomic Power Plant Unit-II is described. Its functions include scanning, computation, alarming logging, routine logging, trending and operator communication.

POWER REACTORS, BREEDING

REFER ALSO TO CITATION(S) 51159, 51446, 51448, 51543, 51657, 51658, 51661, 51662, 51663, 51664, 51665, 51666, 51668, 51669, 51670, 51672, 51673, 51675, 51676, 51684, 51700, 51703, 51704, 51706, 51714, 51715, 51719, 51720, 51723, 51724, 51725, 51726, 51727, 51728, 51729, 51730, 51731, 51732, 51733, 51734, 51735, 51736, 51737, 51738, 51740, 51743, 51744, 51745, 51746, 51747, 51934

51490 (ANL-CT—79-35) **SWAAM prediction of LLTR Series-II A-1a Test.** Shin, Y.W.; Lin, H.C.; Eichler, T.V.; Hsieh, B.J. (Argonne National Lab., IL (USA)). May 1979. Contract W-31-109-ENG-38. 59p. AT.

This report describes the pre-test prediction of the nonreactive nitrogen injection Test A-1a of the LLTR Series-II Test sequence. The test conditions resemble the reactive Test A.2 subcooled water injection at 1700 psia except that the tubeside pressure is increased to 2000 psia to insure activation of the relief system. The relief system activates when the rupture disk fails.

51491 (CONF-790905—1) **Re-evaluating your nuclear program needs: how to benefit from your vendor's Q.A. program.** Cocoros, A.E. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). 1979. Contract EY-76-C-15-2395. 22p. P 02/MF A01.

From American Society for Quality Control conference; Las Vegas, NV, USA (24 Sep 1979).

The quality assurance component control and verification program to be presented provides a cost effective approach to monitoring and controlling the implementation of the design, fabrication, inspection and shipping plans of a supplier. It attempts to coordinate and integrate quality control and verification effort of a supplier with the control and verification effort of the purchaser to obtain a composite which accomplishes a total need. Based on the competency and capabilities of the supplier the purchaser can either maximize the effort the supplier performs or he must maximize his effort to obtain an optimum mix. The ultimate goal is to utilize the supplier's quality assurance program to the greatest benefit in assuring maximum quality.

51492 (COO—2458-22) **Simple representations of spectrum averaged cross sections in LMFBR blankets.** Badruzzaman, A.; Wiley, R.; Becker, M. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Nuclear Engineering). 1978. Contract EY-76-S-02-2458. 7p. (CONF-781105—101). P 02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

The setting up of correlations to represent spectrum averaged cross sections in the core-blanket interface and blanket region of LMFBRs is described. Analytical representations of concentrations as functions of position are used. Sample calculations using a CRBR core composition are presented.

51493 (CRBRP-GEFR-SP—139) **Internal fluid flow management analysis for Clinch River Breeder Reactor Plant sodium pumps.** Cho, S.M.; Zury, H.L.; Cook, M.E.; Fair, C.E. (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Dec 1978. Contract EY-76-C-03-0893-001. 27p. (CONF-781202—41). P 03/MF A01.

From ASME meeting; San Francisco, CA, USA (10 Dec 1978).

The Clinch River Breeder Reactor Plant (CRBRP) sodium pumps are currently being designed and the prototype unit is being fabricated. In the design of these large-scale pumps for elevated temperature Liquid Metal Fast Breeder Reactor (LMFBR) service, one major design consideration is the response of the critical parts to severe thermal transients. A detailed internal fluid flow distribution analysis has been performed using a computer code HAFMAT, which solves a network of fluid flow paths. The results of the analytical approach are then compared to the test data obtained on a half-scale pump model which was tested in water. The details are presented of pump internal hydraulic analysis, and test and evaluation of the half-scale model test results.

51494 (EPRI-NP—1014(Vol.12)) **Pool-type LMFBR plant 1000 MWe Phase A-Extension-2 design. Final report.** (Bechtel National, Inc., San Francisco, CA (USA)). Jun 1979. 109p. P 06/MF A01.

Drawings are presented concerning the reactor head compartment; equipment removal, reactor, and steam generator buildings; IHTS/IRACS piping enclosure; motor control layouts; maintenance and Na storage buildings; rectangular plant arrangement alternate 1; and general arrangement and reactor support buildings.

51495 (ESG-DOE—13273) **Cover gas seal components and reactor components: fuel handling. Quarterly technical progress report, January—March 1979.** (Atomics International Div., Canoga Park, CA (USA)). 15 Jun 1979. Contract EY-76-C-03-0824-011. 28p. AT.

The objectives of the Cover Gas Seal Component test program are to develop and demonstrate the performance of commercial and custom-design head region cavity seals for LMFBR reactors, to develop and evaluate advanced seal concepts capable of

achieving improvement in radioactive gas containment and seal temperature-life capabilities, and to establish operational safety margins for head region seals for nominal and extraordinary LMFBR plant conditions. During FY 1979, the major effort will be directed toward fabricating and performance testing two concepts for flexing metal dynamic seals as alternate concepts to inflatable elastomer seals. The objectives of the Fuel Handling Subcomponent development program are to verify that wetting of the chain will reduce sodium carryover into the EVTM drive components and determine whether or not the chain will remain wetted throughout the EVTM life cycle.

51496 (ESG-DOE—13275) **Acoustic leak detection-location. Quarterly technial progress report, January—March 1979.** (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). 20 Jun 1979. Contract EY-76-C-03-0824-012. 8p. AT.

The objective of this program is to develop a multidimensional detection-location system for steam generator tube leaks. Verification of the detection method will be made by injecting pressurized gas into water in the Hydraulic Test Model at General Electric. Typical background patterns from an operating steam generator will be monitored and recorded using a steam generator at EBR-II. Using data from these and other sources, hard- and software will be developed which can be used for the detection-location of steam generator leaks.

51497 (ETEC—79-1) **Energy Technology Engineering Center (ETEC). Annual technical progress report, January—December 1978.** (Energy Technology Engineering Center, Canoga Park, CA (USA)). 30 Apr 1979. Contract EY-76-C-03-0700. 382p. AT.

Progress is reported for the following LMFBR-related activities: sodium-water reaction testing, subscale inducer pump test, hydraulically supported absorber ball shutdown assembly, articulated control assembly, pipe clamp test program, CRBR small sodium valve testing, gate valve testing, sodium flowmeter testing, pressure transducer testing, sodium-to-gas leak detection, sodium level measurement system testing, electrical resistance heater tests, proximity transducers, strain measurement, development of percussion welding applications, and friction and wear in sodium. (JWR)

51498 (EUR—5807) **Experimental evaluation of the wear of the PEC type fuel element base. Tribological experimental studies in Na at high temperature.** D'Agraives, B.C.; Volcan, A.; Bacchilega, A. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1978. 64p. (In Italian). U 04/MF A01.

Tribological studies in sodium, related to the PEC-type fuel element design are presented. They are aimed at the simulation of friction and wear phenomena which are expected to occur on the surface of fuel element components undergoing solid-solid contact situations with variable loads and/or variable motions. In this first paper, a description of the preparatory work is given. Then, results related to long-duration experiments are shown with respect to the contact between the centering spherical ring belonging to the lower extension of the subassembly, and the cylindrical sleeve of the grid in which it takes place. After 1000 hours under loaded and vibrated conditions, in sodium at 400°C, the wear effects suffered by both contacting samples, are observed and evaluated. The stellite surfaces of the samples are damaged to a not-negligible extent and material transfers from the cylindrical sleeve onto the spherical ring occur.

51499 (GEFR—00355(Rev.1)) **Background noise measurements on prototype of SNR-300 steam generator in the 50 MW test facility at Hengelo, The Netherlands.** Greene, D.A.; Ahlgren, F.F. (General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.). Nov 1978. Contract EY-76-C-03-0893-030. 179p. AT.

Acoustic noise amplitudes were measured in a 50 MW helical coil prototype of a steam generator mounted in the Hengelo test facility in a joint technical program between GE/DOE and TNO/NERATOOM. Background acoustic noise measurements were completed with test conditions ranging from quiescent (with no sodium or water flow) to high thermal power transfer from the sodium circuit to the water circuit. The acoustic noise pressure on the vessel wall was measured using externally mounted accelerometers. Data were obtained for the effect of sodium flow rate on the acoustic noise amplitude. A preliminary correlation is derived for the acoustic noise generated by nucleate boiling of the water. Results indicate that acoustic leak detection/location is feasible for LMFBR steam generators.

51500 (GEFR—00402(Vol.1)) **Pre-irradiation concept description and cost assessment.** Pflasterer, G.R.; Deane, N.A. (comps.). (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Sep 1978. Contract EY-76-C-03-0893-031. 35p. AT.

The objective of this study is to develop a Pre-Irradiation Facility (PIF) design concept, and a preliminary capital and operating cost assessment for this facility, for the purpose of estimating the effect of pre-irradiation on the LMFBR energy cost.

51501 (GEFR—00402(Vol.2)) **Pre-irradiation concept description and cost assessment.** Pflasterer, G.R.; Deane, N.A. (comps.). (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Sep 1978. Contract EY-76-C-03-0893-031. 276p. AT.

A concept evaluation and cost assessment for a water-cooled reactor facility for the pre-irradiation of LMFBR fuel assemblies is described. This study is part of the LMFBR advanced core design program aimed at PLBR development. Volume II contains chapters on the reactor description, plant description, cost assessment, impact of pre-irradiation on LMFBR capital cost, impact of pre-irradiation on LMFBR total energy costs, and demonstration of pre-irradiation concept progress.

51502 (GEFR—00402(Vol.3)) **Pre-irradiation concept description and cost assessment.** Pflasterer, G.R.; Deane, N.A. (comps.). (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Sep 1978. Contract EY-76-C-03-0893-031. 455p. AT.

The various appendices cited in Volumes I and II are included in this volume.

51503 (GEFR—1002[illegible]-69) **Core engineering. Sixty ninth quarterly report, November 1978—January 1979.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Feb 1979. Contract EY-76-C-03-0893-031. 42p. AT.

Progress in LMFBR core engineering is reported under the following headings: fuel assebly engineering, and core component design analysis.

51504 (GEFR—13771-30) **Critical experiments and analysis. Thirtieth quarterly report, January—March 1979.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Apr 1979. Contract EY-76-C-03-0893-031. 57p. AT.

This report is the thirtieth in a series of quarterly reports published under the LMFBR Critical Experiments and Analysis Program. Current activities and technical progress for the period January through March 1979 are reported herein. This report covers the technical direction for critical experiments and analysis as applicable to LMFBR commercial plants and the Clinch River Breeder Reactor Plant.

51505 (GEFR—14073-3) **Nuclear data and methods development and application to LMFBRs. Third annual progress report, fiscal year 1977.** (General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.). 1977. Contract EY-76-C-03-0893-021. 49p. AT.

This report is the third in a series of progress reports published under the Cooperative Nuclear Data and Methods Development Program. The objective of the work reported under this program is to support cooperative evaluations of nuclear data and analytical design tools, to expedite implementation of these in-reactor design applications, and to perform specific analytical physics tasks required to support the Fast Breeder Reactor Program.

51506 (GEFR—14074-11) **Cooperative nuclear data and methods development. Eleventh quarterly report, July—December 1978.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Jan 1979. Contract EY-76-C-03-0893-031. 53p. AT.

The ^{239}Pu to ^{235}U fission cross section ratios were reevaluated in the energy range 0.2 to 12 MeV. The reevaluated ^{239}Pu to ^{235}U fission cross section ratios were used to obtain the ^{239}Pu fission cross sections for ENDF/B-V. To conform with DOE requirements on the release of computer codes, an effort is underway to convert TDOWN-III to the CCCC standard interface format for input/output processing. A more accurate and efficient method for generating the transport kernels used in TDOWN has been developed. It is based on the exact solution of the transport equation in slab geometry, consistent with a flat source assumption. The solution is extended to cylindrical geometry using a slicing technique. Uncertainties in the cross section data for the higher plutonium and americium isotopes were investigated to determine their impact on the important LMFBR design parameters. The results of this investigation indicated that the design calculations are sensitive to the uncertainties in the capture and fission data for ^{240}Pu and ^{241}Pu, and for long-term design applications these uncertainties should be reduced to less than about 10%. The uncertainties in the data for ^{242}Pu and for the americium isotopes have only a small impact on the fast reactor design studies but may be important in the development of schemes for the management of actinide waste discharge and for plutonium burnout. The treatment of control rod heterogeneity effects with two-dimensional modeling was investigated. The results indicate that reasonable k-effectives can be computed for various control in/control out configurations in (X,Y) geometry using axial bucklings obtained from a single (R,Z) problem with central control rod in and with control out annuli representing the remaining control rod positions.

51507 (HEDL-SA—1749-FP) **Effects of stoichiometry on cladding reaction in mixed-oxide fuel.** Lawrence, L.A. (Hanford Engineering Development Lab., Richland, WA (USA)). Apr 1979. Contract EY-76-C-14-2170. 21p. (CONF-790602—75). P 02/MF A01.

From ANS annual meeting; Atlanta, GA, USA (3 Jun 1979).

Initial fuel stoichiometry (oxygen-to-metal ratio, O/M) has been established as one of the major parameters influencing the character and extent of fuel-cladding chemical interaction (FCCI) in UO_2—25 wt% PuO_2 fuels clad with 20% cold worked type 316 stainless steel. How the character of the interaction changes with initial O/M and the O/M dependence that has been established for the depth of interaction are discussed. the data base for this analysis consists of 134 data sets from P-23 series fuel pins irradiated in EBR-II. As-fabricated O/M's ranged from 1.938 to 1.984 with the bulk of the data in the range 1.96 to 1.98. Fuel pins operated to 9.5 atom %, with local cladding inner surface temperatures to 725°C, for exposure times to 415 equivalent full power days at heat rates of ~ 400 W/cm.

51508 (HEDL-SA—1760-FP) **Influence of oxygen-metal ratio on mixed-oxide fuel performance.** Lawrence, L.A.; Leggett, R.D. (Hanford Engineering Development Lab., Richland, WA (USA)). Apr 1979. Contract EY-76-C-14-2170. 21p. (CONF-790602—79). P 02/MF A01.

From ANS annual meeting; Atlanta, GA, USA (3 Jun 1979).

The fuel oxygen-to-metal ratio (O/M) is recognized as an important consideration for performance of uranium—plutonium oxide fuels. An overview of the effects of differing O/M's on the irradiation performance of reference design mixed-oxide fuel in the areas of chemical and mechanical behavior, thermal performance, and fission gas behavior is presented. The pellet fuel has a nominal composition of 75 wt% UO_2 + 25 wt% PuO_2 at a pellet density of ~ 90% TD. for nominal conditions this results in a smeared density of ~ 85%. The cladding in all cases is 20% CW type 316 stainless steel with an outer diameter of 5.84 to 6.35 mm. O/M has been found to significantly influence fuel pin chemistry, mainly FCCI and fission product and fuel migration. It has little effect on thermal performance and overall mechanical behavior or fission gas release. The effects of O/M (ranging from 1.938 to 1.984) in the areas of fuel pin chemistry, to date, have not resulted in any reduction in fuel pin performance capability to goal burnups of ~ 8 atom% or more.

51509 (HEDL-SA—1771) **Design analysis of liquid metal pipe supports.** Margolin, L.L.; LaSalle, F.R. (Hanford Engineering Development Lab., Richland, WA (USA)). Feb 1979. Contract EY-76-C-14-2170. 15p. (CONF-790615—19). P 02/MF A01.

From 3. US national congress on pressure vessels and piping; San Francisco, CA, USA (25 Jun 1979).

Design guidelines pertinent to liquid metal pipe supports are presented. The numerous complex conditions affecting the support stiffness and strength are addressed in detail. Topics covered include modeling of supports for natural frequency and stiffness calculations, support hardware components, formulas for deflection due to torsion, plate bending, and out-of-plane flexibility. A sample analysis and a discussion on stress analysis of supports are included. Also presented are recommendations for design improvements for increasing the stiffness of pipe supports and which were utilized in the FFTF system.

51510 (HEDL-SA—1787-FP) **Failure location analysis for tagged reactor assemblies.** Figg, J.A. (Hanford Engineering Development Lab., Richland, WA (USA)). Mar 1979. Contract EY-76-C-14-2170. 12p. (CONF-790698—2). P 02/MF A01.

From Society of Women Engineers national student conference; San Francisco, CA, USA (27 Jun 1979).

The location of defective LMFBR fuel pins by the determination of gas tag isotopic ratios is discussed. The application of this method to the FFTF Reactor briefly described.

51511 (HEDL-TME—78-115) **Breeder reactor reference control materials. Semiannual status newsletter, June—December 1978.** Roake, W.E. (Hanford Engineering Development Lab., Richland, WA (USA)). May 1979. Contract EY-76-C-14-2170. 49p. AT.

Progress in the development of LMFBR reference core materials is reported under the following heading: improved absorber concepts, design and performance analysis, materials testing and characterization, feature testing, neutron absorber performance monitoring, and fabrication and procurement.

51512 **Material problems in accident analysis of prestressed concrete reactor vessels.** Bazant, Z.P. (Northwestern Univ., Evanston, IL (USA). Dept. of Civil Engineering). pp E6/1 1-7 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

Due to their very high energy absorption capability, as well as their inherent safety advantages, prestressed concrete reactor vessels are presently being keenly studied as the basic barrier to contain hypothetical core disruptive accidents in a fast breeder reactor. One problem investigated is the nonlinear constitutive behavior and failure criteria for concrete. Previously, a comprehensive theory, called endochronic theory, has been shown to satisfy all basic currently known features of test data. Nevertheless uncertainty still exists with regard to non-proportional loading paths, for which good test data are lacking at present. An extension of the endochronic theory which correlates best with general experimental evidence and includes fracturing terms is given, and a comparison with vertex-type hardening in plasticity is made. A second problem which must be analysed in accident situations is the high temperature shock on the concrete walls (due to liquid sodium, up to 850°C). Refining a previous crude formulation, a rational model for calculating moisture and heat transfer and pore pressures in concrete subjected to thermal shock is presented. In conclusion, a new design concept, in which the concrete vessel is completely dehydrated and kept hot throughout its service life in order to substantially improve its response to thermal shock as well as liquid sodium contact, is described.

51513 (KFK-tr—578) **Some problems of operation behaviour of hexagonal boxes for fuel elements of fast power reactors.** Proshkin, A.A.; Zabud'ko, L.M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Internationales Buero/Uebersetzergruppe). Jun 1978. 59p. (In German). U 04/MF A01.

The present work shows a method to determine the operational behaviour of hexagonal fuel cans for fast reactors by using tensions caused by the coolant pressure, and tensions due to a possible interaction of the fuel rod bundle and the can with axial symmetrical temperature distribution, taking into account the change of physical and mechanical, material properties of the can during irradiation. A few questions on the statistical assessment of the operational behaviour of the can are considered, based on which one can determine the probability of damaging the fuel cans during reactor operation and the contribution of various factors on the non-safeness in calculating the cans' operational behaviour. An example is given for the calculation of a fuel can for a large power plant based on the method shown.

51514 (NUREG/CR—0906) **Dynamic intragranular fission gas behavior model.** Catton, I.; Kastenberg, W.E. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). Jul 1979. 214p. C.

A model for the non-equilibrium behavior of intragranular fission gas in oxide fuel is developed to study the fundamental phenomena that determine fission gas effects in the fuel. The model explicitly represents the dynamic behavior of point defects and includes the effects of variations in stoichiometry. The mathematics of the model use the principle of moments invariance to allow approximations that significantly reduce computational expense without sacrificing accuracy. The model is intended for use as a tool to identify and explore important variables in the behavior of fission gas and determine the regimes of validity of the various modeling assumptions. The Dynamic Intragranular Gas Release and Swelling (DIGRAS) computer code developed in this work is applicable to simulations of both steady-state and transient irradiations. Flexibility is built into the code and a summary of the physical process dynamics is included in the code output.

51515 (ORNL—5229/R1) **Input data requirements for special processors in the computation system containing the VENTURE neutronics code.** Vondy, D.R.; Fowler, T.B.; Cunningham, G.W. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-48. 51p. P 04/MF A01.

User input data requirements are presented for certain special processors in a nuclear reactor computation system. These processors generally read data in formatted form and generate binary interface data files. Some data processing is done to convert from the user oriented form to the interface file forms. The VENTURE diffusion theory neutronics code and other computation modules in this system use the interface data files which are generated.

51516 (ORNL—5551) **Analysis of the ORNL/TSF GCFR Grid-Plate Shield Design Confirmation Experiment.** Slater, C.O.; Cramer, S.N.; Ingersoll, D.T. (Oak Ridge National Lab., TN (USA)). Aug 1979. Contract W-7405-ENG-26. 172p. P 08/MF A01.

The results of the analysis of the GCFR Grid-Plate Shield Design Confirmation Experiment are presented. The experiment, performed at the ORNL Tower Shielding Facility, was designed to test the adequacy of methods and data used in the analysis of the GCFR design. In particular, the experiment tested the adequacy of methods to calculate: (1) axial neutron streaming in the GCFR core and axial blanket, (2) the amount and location of the maximum fast-neutron exposure to the grid plate, and (3) the neutron source leaving the top of the grid plate and entering the upper plenum. Other objectives of the experiment were to verify the grid-plate shielding effectiveness and to assess the effects of fuel-pin and subassembly spacing on radiation levels in the GCFR. The experimental mockups contained regions representing the GCFR core/blanket region, the grid-plate shield section, and the grid plate. Most core design options were covered by allowing: (1) three different spacings between fuel subassemblies, (2) two different void fractions

within a subassembly by variation of the number of fuel pins, and (3) a mockup of a control-rod channel.

51517 (ORNL/BRP—79/3) **Nondestructive testing development program semiannual progress report for period ending March 31, 1979.** McClung, R.W. (comp.). (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 94p. AT.

Nondestructive testing (NDT) research for LMFBR components is summarized. The work covered NDT techniques and equipment for inspection and monitoring of steam generators and piping. The NDT techniques included ultrasonics, radiography, and eddy current testing.

51518 (TID—28937) **Review of literature on unsteady forced convection heat transfer with application to LMFBR thermal striping.** Snyder, P.H. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). Jan 1979. Contract EY-76-C-15-2395; EY-78-C-15-0003. 47p. AT.

A literature review was conducted to determine what techniques are available to predict the unsteady forced convection heat transfer behavior of LMFBR upper core parts. The most suitable techniques are explored and pertinent methods are evaluated and extended to analyze the problem at hand. It is determined that available methods employ assumptions too restrictive to analyze the required situation and that further work should be aimed at the extension of these methods.

51519 (WARD-OX—3045-32) **Oxide fuel element development. Quarterly progress report for period ending June 30, 1977.** Boltax, A.; Cooper, M.H. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Reactors Div.). Jun 1979. Contract EY-76-C-02-3045-007;EY-76-C-3045-008;EY-76-C-02-3045-009. 100p. AT.

Progress is reported in the following studies: coordination of mixed-oxide irradiation tests, post-irradiation examination of fast reactor experiments, evaluation and analysis of fuel and cladding irradiation behavior, radial blanket irradiation tests in ERB-2, grid-type fuel assembly mechanical design, grid fabrication and tests, and fuel pin design criteria and code developments. (JWR)

51520 (WARD-OX—3045-34) **Oxide fuel element development. Quarterly progress report for period ending September 30, 1977.** Boltax, A.; Cooper, M.H. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). Jun 1979. Contract EY-76-C-02-3045-007;EY-76-C-02-3045-008;EY-76-C-02-3045-009. 113p. AT.

Studies on LMFBR grid-type fuel assembly mechanical design include mixed-oxide irradiation tests; post-irradiation examination of fast reactor experiments; evaluation and analysis of fuel and cladding irradiation behavior; radial blanket irradiation tests in EBR-2; grid type fuel assembly mechanical design; fabrication, development, and testing of breeder reactor fuel assemblies; and fuel pin design criteria and code development.

51521 (WARD-RB—3045-29) **Radial blanket design and development. Quarterly progress report for period ending May 31, 1978.** Bishop, E.C.; Yingling, J.E. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). Jun 1979. Contract EY-76-C-02-3045-004. 85p. AT.

Information is presented concerning radial blanket assembly heat transfer testing; radial blanket assembly irradiation; radial blanket flow orificing; and radial blanket rod bundle compaction tests.

51522 (WARD-RB—3045-30) **Radial blanket design and development. Quarterly progress report for period ending August 31, 1978.** Bishop, E.C.; Yingling, J.E. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). Jun 1979. Contract EY-76-C-02-3045-004. 79p. AT.

Information is presented concerning radial blanket assembly heat transfer testing; radiai blanket assembly irradiation; radial blanket flow orificing; and radial blanket rod bundle compaction tests.

51523 (WARD-SD—94000-1) **Creep tensile instability.** O'Donnell, W.J.; Porowski, J.S. (O'Donnell and Associates, Inc., Pittsburgh, PA (USA)). Jul 1979. Contract EY-76-C-02-3045-032. 46p. AT.

Creep tensile instability solutions are obtained for most cases encountered in design applications. These include: (1) membrane load stresses of arbitrary biaxiality, (2) pressurized spherical vessels, and (3) pressurized cylindrical vessels and piping with combined axial loads. Solutions are obtained for both the effective (Mises) strains and the maximum tensile strains at instability. The results show that neither Triaxiality Factors nor factors based on plastic tensile instability solutions can be used to convert creep rupture ductility data to safe allowable design values for components operating in the creep regime. The present solutions can be used to obtain allowable strains for design applications using available uniaxial creep rupture ductility data.

51524 (WARD-XS—94000-1) **Physics evaluations and applications. Quarterly progress report for period ending April 30, 1979.** Yarbrough, M.B.; Varner, S.K. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Reactors Div.). Jun 1979. Contract AM02-76CH94000. 15p. AT.

Current progress in LMFBR physics evaluations is reported in the following areas: three-dimensional perturbation module implementation and testing and a non-refueling ^{235}U-fueled LMFBR.

51525 **Fabrication of grid-spaced bundle for the F-5 (X317) irradiation experiment.** Lindgren, J.R.; Flynn, P.W.; Foster, L.C. (General Atomic Co., San Diego, CA). *Nucl. Technol.;* **44**: No. 3, 433-444(Aug 1979).

The fabrication of special components and hardware and the assembly of the grid-spaced bundle for the gas-cooled fast breeder reactor (GCFR) F-5 (X317) irradiation experiment now being irradiated in row 5 of the Experimental Breeder Reactor II are described. The F-5 experiment consists of 31 fueled rods and six coolant bypass tubes for the initial loading. The components fabricated and assembled by General Atomic Company are ribbed cladding, UO_2 blanket pellets (80% +- 2% TD), fission product traps, dosimeters, insulated flow bypass tubes, grid spacers, specially shaped axial spacer tubes, a thermal shield/orifice/flow mixer, a bundle attachment ring, hexagonal tubes with key slots for rod holddown, a rail assembly with attachment to the bottom subassembly shield, dummy fuel rods for flow testing, and assembly of the grid-spaced bundle including check-fit into the flow duct. A variety of fabrication methods, including powder pressing, sintering, outer diameter grinding, thread grinding, metal forming, machining, chemical milling, electrical discharge machining, and tungsten inert gas welding, were used to produce the components.

51526 **Experimental study of scram transients in generalized liquid-metal fast breeder reactor outlet plenums.** Howard, P.A.; Carbajo, J.J. (Argonne National Lab., IL). *Nucl. Technol.;* **44**: No. 2, 210-220(Jul 1979).

An experimental study was made of the transient behavior of the coolant in a generalized outlet plenum after a scram in a liquid-metal fast breeder reactor. Different conditions of fluid flow rate and temperature and plenum geometry were used for a three-exit loop-type reactor system. Water was used to simulate the coolant, and a small-scale model was used to simulate the various generalized plenum configurations. Thermocouples monitored the temperatures at 48 locations within the outlet plenum. The thermohydraulic behavior within the plenum has been studied in detail; analysis of this behavior is described as having three consecutive discrete stages. Correlations found in the literature accurately predict the height of the negatively buoyant plume. New correlations have been obtained.

51527 **Optimization of the Westinghouse/Stone and Webster prototype large breeder reactor.** Anderson, C.A. Jr. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Reactors Div.). pp 247-259 of Optimization of sodium-cooled fast reactors. London; Thomas Telford for the British Nuclear Energy Society (1978).

From BNES conference on optimization of sodium cooled fast reactors; London, UK (28 Nov 1977).

The optimization of the Westinghouse/Stone and Webster Prototype Large Breeder Reactor (PLBR) is described. This reactor plant, designed for ERDA and EPRI, resulted from optimization and tradeoffs on plant size, number of loops, steam cycles, system temperature, pump location, refueling concept, reactor shut-down system logic, control system logic, steam generating system, residual heat removal system, core arrangement and reactor vessel. The result is a three loop LMFBR rated at 1000 MWe gross with sodium entering the reactor vessel at 650°F (345°C) and leaving at 950°F) (510°C). The reactor vessel has a flat closure head on top, containing three rotating plugs on which are mounted the upper internals structure and the in-vessel transfer machine. The core has three radial layers of core material separating four radial blanket regions. An inclined refueling chute penetrates the reactor vessel. Plant efficiency of 37% is achieved with the use of once-through steam generators operating in the modified Sulzer mode, producing 2200 psi, 850°F (15.2 x 10^6 pa/455°C) steam. The residual heat removal system (RHRS) consists of three independent heat removal paths in which the intermediate sodium is cooled in air blast heat exchangers (author).

51528 **Potential of large heterogeneous reactors.** Barthold, W.P.; Tzanos, C.P.; Beitel, J.C. (Argonne National Lab., IL (USA)). pp 279-290 of Optimization of sodium-cooled fast reactors. London; Thomas Telford for the British Nuclear Energy Society (1978).

From BNES conference on optimization of sodium cooled fast reactors; London, UK (28 Nov 1977).

Different 1200 MWe heterogeneous core configurations have been evaluated and compared with a homogeneous 1200 MWe LMFBR design. This study discusses the neutronic coupling concept which was employed to discriminate between different heterogeneous core designs. Reactivity control, breeding performance, safety parameters, fuel pin optimization, transient behaviour and thermal performance were investigated in detail and results of these analyses are presented.

51529 Eulerian algorithm for analyzing fluid-structure interaction in the fast reactor containment. Wang, C.Y.; Chang, Y.W.; Fistedis, S.H. (Argonne National Lab., IL (USA)). pp E1/3 1-11 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

This paper presents an algorithm for analyzing the coupled fluid-structure problems in the LMFBR consisting of various internals and primary vessel. The aim is at the development of a generalized Eulerian hydrodynamic scheme, which can be used to link together the ICE technique with the finite-element structural dynamics method to provide sliding capability at interface, modeling of perforated structure, and analyses of fluid motions at the geometry discontinuity. Since the finite-element method has been already well developed, the work described concentrates on the fluid-structure interaction. The algorithm uses the Eulerian description in the hydrodynamic formulation principally because it has the deciding advantage of treating excessive distortion. It employs the implicit temporal integration scheme to solve the nonlinear, time-dependent equations of fluid mechanics. This scheme not only insures computational stability, but also eases the Couriant condition on the time step. Furthermore, the Implicit treatment of pressure and velocity fields allows the presence of all flow-speed regimes. Hence, the algorithm is applicable to any degree of excursion. Two sample problems are given, concerning wave propagation in a typical LMFBR which consists of radial shield, core barrel, core-support structure, and the primary vessel.

51530 Fracture of longitudinally cracked ductile tubes. Bernard, J.; Larsson, H.; Reynen, J. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). pp F7/3 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51531 Vapor transport and pressure rise behind the liner of reactor containments. Kordina, K.; Schneider, U. (Technische Univ. Braunschweig (Germany, F.R.)). pp E6/3 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51532 Response of water-filled pipes to pressure pulses. Romander, C.M.; Cagliostro, D.J.; Florence, A.L.; Gran, J.K. (Stanford Research Inst., Menlo Park, CA (USA). Poulter Labs.). pp E4/7 1-11 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

Argonne National Laboratory has developed two-dimensional axisymmetric fluid-structure-interaction codes to predict the pressures and strains in the primary piping loop caused by HCDA-generated pressure pulses. Verification of these codes requires simple, well-defined experiments in which scale models of the primary piping are loaded with pressure pulses and the pressures, strains, and deformation in the pipe are measured. This paper presents the results of such an experimental program. Experiments were performed on 5-foot-long (3 inch OD, 0.065 inch wall) Ni 200 pipe sections filled with water. Experimental results are compared with predictions from a one-dimensional, method-of-characteristics computer analysis of pressure pulses propagating in a plastically deforming pipe.

51533 DDT - a 3-dimensional program for the analysis of bowed reactor cores. Menssen, R. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). pp D2/4 1-12 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The influence of temperature gradients, neutron fluence gradients and irradiation induced creep leads to individually different bowing effects of all elements in a core of a fast reactor. subsequent contacts between neighbouring elements result in forces of different value. Eventually all elements will arrange in such a way, that an equilibrium of forces between all elements is achieved. The determination of this equilibrium configuration in different operational states of the reactor is of high significance especially for safety aspects. For this reason, in addition to existing 2-dimensional codes, a 3-dimensional code was developed to allow a good description of the whole core bowing behaviour. Because of nonlinearities, standard mathematical techniques for solving linear structural problems are not directly applicable. So an iterative procedure is applied to achieve the equilibrium force configuration. Each iteration step corrects the largest force discrepancy between neighbouring elements. This technique requires a long computer running time to converge, but the locations of gaps and contacts normally do not change if a rough equilibrium is found.

51534 Characterization of residual stress profiles in irradiated fuel pin cladding. Nygren, R.E. (Hanford Engineering Development Lab., Richland, WA (USA)). pp C2/5 1-9 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

During reactor operation a radial temperature gradient exists through the fuel pin cladding. The temperature gradient causes stress through differential thermal expansion and differential swelling. This paper describes a method for determining actual residual stress profiles in cladding. Work of this nature is currently in progress. The experimental method begins by measuring the diameter of a tubular specimen and then slitting the wall of the specimen axially and remeasuring the diameter. Successive, uniform layers of material are removed from the tube wall and after each increment of wall thinning the diameter is measured. The experimental goal is to provide enough data to describe the free deflection ΔD as a function of the wall thinning. Two specific applications for characterizing the residual stress in irradiated fuel pin cladding with limited, discrete data are developed in the paper. One represents a minimum effort approach and requires only four pairs of data. The end product is a 'curve' consisting of four linear segments that approximates the residual stress profile of the cladding specimen. The second technique is a semi-analytical technique for statistically fitting an assumed curve form to the data.

REGULATION AND LICENSING

51535 (EUR—5849) **Catalogue and classification of technical safety standards, rules and regulations for nuclear power reactors and nuclear fuel cycle facilities.** Fichtner, N.; Becker, K.; Bashir, M. (Commission of the European Communities, Luxembourg). 1977. 591p. U 25/MF A01.

The present report is an up-dated version of the report 'Catalogue and Classification of Technical Safety Rules for Light-water Reactors and Reprocessing Plants' edited under code No EUR 5362e, August 1975. Like the first version of the report, it constitutes a catalogue and classification of standards, rules and regulations on land-based nuclear power reactors and fuel cycle facilities. The reasons for the classification system used are given and discussed.

51536 (NUREG—0020(Vol.3)(No.7)) **Licensed operating reactors. Operating units status report, data as of 6-30-79.** (Nuclear Regulatory Commission, Washington, DC (USA)). Jul 1979. 172p. C $12.50.

This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices and IE Headquarters; and the third section is an appendix containing comparative statistics of US nuclear/fossil capacity, identification of nuclear power plants within regional Electric Reliability Councils, the relative status of US nuclear electric production by state and other information.

51537 (NUREG—0030(Vol.2)(No.2)) **Construction status report. Nuclear power plants, data as of April 30, 1979.** (Nuclear Regulatory Commission, Washington, DC (USA)). May 1979. 162p. C .

Data on the construction status of nuclear power plants in the US as of April 30, 1979 are presented. The data include licensing activities affecting the construction as well as detailed information on construction activities and schedules.

ECONOMICS

51538 Why nuclear energy. Hill, J. (UKAEA). pp 4-11 of Geological aspects of uranium in the environment. Duff, P.McL.D. (ed.). London; Geological Society (1978).

From Conference on geological aspects of uranium in the environment; Strathclyde, UK (12 Nov 1977).

The economics of energy supply are discussed and the need for nuclear power is argued. The problems of future uranium supplies are outlined. The timescale involved in any decision to build a series of fast reactors is explained.

FUEL CYCLE

REFER ALSO TO CITATION(S) 51154, 51179

51539 (EUR—5936) **Prospects for plutonium recycling in light-water reactors in the European Communities.** Haijtink, B. (Commission of the European Communities, Luxembourg). 1977. 24p. U 03/MF A01.

On the basis of a forecast on nuclear power installation programmes and spent nuclear fuel reprocessing capacities in the European Community, an assessment has been made of the developmnt of the plutonium handling industry up to the year 1990. Data on plutonium recovered in the reprocessing plants, requirements for fuelling the fast-breeder reactors and the remaining stockpile have been evaluated. A possible strategy for recycling the plutonium surplus in light-water reactors has been developed and its effects as regards saving on requirements for natural uranium and enrichment services have been estimated.

51540 (ORNL/TM—6685) **Evaluation of fuel fabrication and the back end of the fuel cycle for light-water- and heavy-water-cooled nuclear power reactors.** Carter, W.L.; Olsen, A.R. (Oak Ridge National Lab., TN (USA)). Jun 1979. Contract W-7405-ENG-26. 115p. P 06/MF A01.

The classification of water-cooled nuclear reactors offers a number of fuel cycles that present inherently low risk of weapons proliferation while making power available to the international community. Eight fuel cycles in light water reactor (LWR), heavy water reactor (HWR), and the spectral shift controlled reactor (SSCR) systems have been proposed to promote these objectives in the International Fuel Cycle Evaluation (INFCE) program. Each was examined in an effort to provide technical and economic data to INFCE on fuel fabrication, refabrication, and reprocessing for an initial comparison of alternate cycles. The fuel cycles include three once-through cycles that require only fresh fuel fabrication, shipping, and spent fuel storage; four cycles that utilize denatured uranium—thorium and require all recycle operations; and one cycle that considers the LWR—HWR tandem operation requiring refabrication but no reprocessing.

PROCESS HEAT REACTORS

51541 (EUR—5724) **Energetical and economical assessment of the waste heat problem.** Demicheli, U.; van der Voort, E.; Schneiders, A.; Zegers, P. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1977. 56p. U 04/MF A01.

Electrical power plants produce large quantities of low grade heat that remain unused. For ecological reasons this waste heat must be dispersed by means of expensive cooling devices. Waste heat could be used in acquacultural and agricultural complexes this replacing large amounts of primary energy. Energetical and economical aspects are discussed. The state of the art of these and other utilisations is outlined. A different approach to the problem is to reduce the production of waste heat. Various strategies to achieve this challenge are outlined and their actual state and possible future developments are discussed. Finally, the various most promising utilizations are examined from an energetical point of view.

51542 (GA-A—15494) **Design of an HTGR for high-temperature process heat applications.** Vrable, D.L.; Quade, R.N.; Stanley, J.D. (General Atomic Co., San Diego, CA (USA)). Jul 1979. Contract EY-76-C-03-0167. 10p. (CONF-791006—1). P 02/MF A01.

From Joint power generation conference; Charlotte, NC, USA (7 Oct 1979).

The high-temperature gas-cooled reactor (HTGR) offers a unique heat source for process heat applications since its operating temperature is substantially higher than that of other types of nuclear reactors. This paper discusses a design study of an advanced 842-MW(t) very high temperature reactor (VHTR) coupled with a chemical process whose product is hydrogen (or a mixture of hydrogen and carbon monoxide) generated by steam reforming of a light hydrocarbon mixture. A key feature of the plant is the nuclear reactor core, which utilizes helium as its primary coolant, has ceramic-coated fuel particles containing uranium and thorium, and employs graphite as the moderator and structural material. As in other HTGR designs, the VHTR has its entire primary coolant system contained in a prestressed concrete reactor vessel (PCRV) which provides the necessary biological shielding and pressure containment. The high-temperature nuclear thermal energy is transported to the externally located process plant by a secondary helium transport loop. In addition to providing the thermal driving potential required for the reforming process, the nuclear heat is also used to generate high-temperature, high-pressure steam to satisfy both the process and electrical generation needs for the operation of the nuclear plant and reforming process plant.

NUCLEAR REACTOR TECHNOLOGY

THEORY AND CALCULATION

REFER ALSO TO CITATION(S) 52318

51543 (COO—2250-37) **Interfacial effects in fast reactors.** Saidi, M.S.; Driscoll, M.J. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). May 1979. Contract EY-76-S-02-2250. 196p. P 09/MF A01.

The problem of increased resonance capture rates near zone interfaces in fast reactor media has been examined both theoretically and experimentally. An interface traversing assembly was designed, constructed and employed to measure U-238 capture rates near th blanket—reflector interface in the MIT Blanket Test Facility. Prior MIT experiments on a thorium—uranium interface in a blanket assembly were also reanalyzed. Extremely localized fertile capture rate increases of on the order of 50% were measured immediately at the interfaces relative to extrapolation of asymptotic interior traverses, and relative to state-of-the-art (LIB-IV, SPHINX, ANISN/2DB) calculations which employ infinite-medium self-shielding throughout a given zone. A method was developed to compute a spatially varying background scattering cross section per absorber nucleus which takes into account both homogeneous and heterogeneous effects on the interface flux transient.

51544 (EUR—5658) **Application of heterogeneous method for the interpretation of exponential experiments.** Birkhoff, G.; Bondar, L. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1977. 44p. U 03/MF A01.

The present paper gives a brief review of a work which was executed mainly during 1967 and 1968 in the field of the application of heterogeneous methods for the interpretation of exponential experiments with ORGEL type lattices (lattices of natural uranium cluster elements with organic coolants moderated by heavy water). In the frame of this work a heterogeneous computer program, in (r,γ) geometry was written which is based on the NORDHEIM method using a uniform moderator, three energy groups and monopol and dipol sources. This code is especially adapted for regular square lattices in a cylindrical tank. Full use of lattice symmetry was made for reducing the numerical job of the theory. A further reduction was obtained by introducing a group averaged extrapolation distance at the external boundary. Channel parameters were evaluated by the PINOCCHIO code. Comparisons of calculated and measured thermal neutron flux showed good agreement.

51545 (EUR—5667(Pt.2), pp 468-683) **Neutron flux density spectra of interest to reactor neutron metrology.** Zijp, W.L.; Nolthenius, H.J.; Rieffe, H.C. 1977.

From 1. ASTM-Euratom symposium on reactor dosimetry; developments and standardization; Petten, Netherlands (22 Sep 1975).

This document presents a collection of neutron flux density spectra of interest to reactor neutron metrology. The flux density spectra are shown in a series of figures, while values of group flux densities are presented too. For each spectrum the average energy and the average neutron speed is calculated. Also some damage characteristics of the spectra are included in the tables. No special normalization of the spectra was applied.

51546 (EUR—5709) **Delay function in finite difference models for nuclear channels thermo-hydraulic transients.** Agazzi, A. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1977. 38p. U 03/MF A01.

The study of the thermo-hydraulic transients in a nuclear reactor core often requires a bi- or tri-dimensional mathematical simulation of a reactor channel. The equations involved are generally solved by means of finite-difference methods. The determination of the spatial mesh-width and the time interval is strongly conditioned by the necessity of a good accuracy in the description of the delay function which defines the transfer of thermal perturbations along the cooling channel. The effects of both space and time discretization on the delay function are considered and for the classical cases of inlet temperature step and ramp universal functions and diagrams are given in order to make possible the determination of optimal spatial mesh-width and time interval, once the requested accuracy of the model is fixed in advance.

51547 (EUR—5763) **Analytical evaluation of actinide sensitivities.** Sola, A. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1977. 384p. U 17/MF A01.

The analytical evaluation of the sensitivities of actinides to various parameters such as cross sections, decay constants, flux and time is presented. The formulae are applied to isotopes of the Uranium, Neptunium, Plutonium and Americium series. The agree-

ment between analytically obtained and computer evaluated sensitivities being always good, it is thought that the formulation includes all the important parameters entering in the evaluation of sensitivities. A study of the published data is made.

51548 (EUR—5853) **Sensitivity analysis of the effect of various key parameters on fission product concentration (mass number 120 to 126).** Sola, A. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1978. 326p. U 15/MF A01.

An analytical sensitivity analysis has been made of the effect of various parameters on the evaluation of fission product concentration. Such parameters include cross sections, decay constants, branching ratios, fission yields, flux and time. The formulae are applied to isotopes of the Tin, Antimony and Tellurium series. The agreement between analytically obtained data and that derived from a computer evaluated model is good, suggesting that the analytical representation includes all the important parameters useful to the evaluation of the fission product concentrations.

51549 (EUR—5892) **Experimental determination of neutron capure cross-sections of structural materials for fast reactors integrated over the intermediate energy region. I. Description of experiments.** Tassan, S. (Commission of the European Communities, Luxembourg). 1978. vp. (In Italian). U 18/MF A01.

The report is a selection of technical documents related to the performance of the collaboration contracts 029-71 and 110-73 PIPGI, among AGIP NUCLEARE SpA, CNEN-Centro di Calcolo (Bologna Italy) and JRC-Ispra Establishment, for the experimental determination of neutron capture cross-sections of structural materials for fast reactors (Fe, Ni, Cr, etc.) integrated over the intermediate energy region. The chapters of this first volume of the report are: description of the experiment; feasibility studies related to the test medium; theoretical calculation for the definition of the main experimental parameters; a-priori experimental error analysis.

51550 (FEI—827) **Transformation of the P1-approximation set of equations into a diffusion equation retaining linearity of boundary conditions.** Suslov, I.R. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1978. 6p. (In Russian). U 02/MF A01.

The finite element method was applied to the calculation of two-dimensional reactor models in many-group P1 approximation of the spherical harmonics method. So the way to reduce the problem to a diffusional one with retaining linearity of conditions on boundaries spreads to the many-dimensional case.

51551 (LA—7878-PR) **Reactor technology. Progress report, January—March 1979.** Breslow, M. (ed.). (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 155p. P 08/MF A01.

Significant progress is reported in the technical feasibility program of the Space Reactor Technology Program, including: thermoelectric material samples were made with an implied overall converter efficiency of 8.5%; maximum UO_2-fuel temperature in the core was computed to be approximately 1700 K with contact requirement between the molybdenum fins and core heat pipe of 10-15%; a design reliability of 0.99 for the core heat pipes and thermoelectric modules has been established; and an assessment of powerplant requirements indicates we can meet our original design goals. Activities in the Reactor Structural Investigations Program included work in the experimental seismic program and structural work related to the Fort St. Vrain temperature fluctuation problem. Work on the Ceramic Heat Pipe Technology Development Program has included the experimental determination of the operating characteristics of ceramic heat pipe configurations, resolution of necessary heat pipe fabrication methods, and investigation of basic heat pipe operating characteristics for both the mercury heat pipe and for an annular heat pipe used for optical system cooling. The Nuclear Criticality Operations and Safety Program is investigating the development of a solution burst reactor, which could deliver a leakage neutron flux of sufficient magnitude and proper spectrum to be of interest for weapon-component vulnerability studies. Preliminary experiments have been conducted by the Nuclear Pumped Laser Program to measure the efficiency of conversion of fission fragment energy to excited electronic state energy.

51552 (PNL—3086) **MCDAN: a Monte Carlo computer code for calculating the Dancoff correction factor for spheres and rods.** McNeece, J.P.; Trapp, T.J.; Thompson, J.K. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Aug 1979. Contract EY-76-C-06-1830. 24p. P 02/MF A01.

MCDAN is a computer code that uses Monte Carlo techniques to calculate the Dancoff correction factor for arrays of spheres or rods. Neutrons are started from the surface of the sphere (rod) and tracked until they intersect another sphere (rod). The histories of a number of neutrons are statistically combined to give a value for the Dancoff correction factor. MCDAN was written as a tool to verify the accuracy of an expression for the Dancoff correction factor used in a study of the reactivity effect of fuel particles in uranium—water mixtures. The accuracy of MCDAN has been verified by comparison with tabulated data for systems of two spheres (rods).

COMPONENTS AND ACCESSORIES

51553 (CONF-790745—2) **Horizontal two-phase flow transit time measurements.** Baker, A.G. (Idaho National Engineering Lab., Idaho Falls (USA)). 1979. Contract EY-76-C-07-1570. 27p. P 03/MF A01.

From Reactor Safety Instrumentation Review Group meeting; Silver Spring, MD, USA (24 Jul 1979).

A transit time flowmeter (TTF) indirectly determines fluid velocity by measuring the time of transit of the fluid between two sensors of known separation. The transit time is obtained by cross-correlation, and the velocity by dividing the intersensor separation distance by the transit time. Various sensors were tested for suitability. Performance was determined by comparison of the TTF velocity to that computed from or indicated by the instrumentation of the test facilities. Conductivity probes, single-beam gamma densitometers, and Pitot tubes were tested in steady state air-water conditions. The densitometers performed best, followed by the conductivity probes and the Pitot tubes. Stratification effects were detected in this horizontal flow application which confuse a straightforward interpretation of the TTF velocity.

51554 (CONF-790841—1) **Automated welding of nuclear piping systems.** Hood, D.W. (Idaho National Engineering Lab., Idaho Falls (USA)). 1979. Contract EY-76-C-07-1570. 5p. P 02/MF A01.

From AWS maintenance welding in nuclear power plants conference; Atlanta, GA, USA (6 Aug 1979).

Automated welding, or more broadly, automatic and mechanized welding processes, has found a role in nuclear power plant fabrication. This role has expanded from a rare or isolated application to relatively frequent usage in the last five years. More importantly, it is envisioned that use of automated welding will be increasing at an accelerated rate as broader exposure to this technology is achieved. Among the various pipe welding processes, the only one which has been developed for mechanized and automated nuclear piping welding is the gas tungsten arc welding (GTAW) process. This development has occurred in the past 10 to 15 years through the steady improvement and commmercialization of orbiting welding heads. Improvements in GTAW power supplies, control systems, etc., have aided this commercialization but the main element and pacing item has been the welding head itself. In order to review the status of mechanized and automated nuclear pipe welding, the topics of basic process equipment, joint design, fit-up requirements, welding parameters, and producibility will be addressed. In addition, anticipated future developments in automated systems will be discussed.

51555 (GA-A—15400) **Anchor stud monotonic and cyclic shear tests. Final report.** Pickering, J.L. (General Atomic Co., San Diego, CA (USA)). Jul 1979. Contract EY-76-C-03-0167-061. 94p. P 05/MF A01.

In a prestressed concrete reactor vessel (PCRV), the main cavity liner and other cavity liners with large diameter/thickness (D/t) ratios are anchored to the concrete by anchor studs. These anchor studs are subject to shear loading resulting from prestressing, pressurization, temperature, and creep of the PCRV. The test program discussed in this report consists of both monotonic and cyclic testing of models simulating the prototype anchor stud/concrete assembly. The tests determined the shear stiffness characteristics of the 3/4-in.-diameter, one-piece Nelson anchor stud embedded in concrete and established its low-cycle fatigue life under displacement-controlled loading. The previously obtained results of Phase I and Phase II tests on two-piece anchor studs, along with high-cyclic fatigue data taken from the literature, are discussed and are plotted with the current, Phase III, results to form a displacement versus cycles to failure curve covering a useful range of design applications.

51556 (HEDL—6475) **Heavy Section Steel Technology Program: irradiation effects on the fracture toughness of heavy section pressure vessel steels. Quarterly progress report for period ending February 28, 1979.** Carlson, K.W.; Williams, J.A. (Hanford Engineering Development Lab., Richland, WA (USA)). 9 Mar 1979. Contract EY-76-C-14-2170. 12p. P 02/MF A01.

The extensometry study was completed and the results compiled. This study defined the accuracy and capability of the LVDT and clip gage extensometers used in the J-integral studies. This investigation led to some extensometry improvements and the establishment of test-ready conditions and procedures for J-integral tests using the unloading compliance method. Using these established procedures, the a/w-facegroove matrix specimens were successfully tested.

51557 (IJS—106/5019-77) **Cooling methods for power plants.** Gaspersic, B.; Fabjan, L.; Petelin, S. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). 1977. 84p. (In Slovenian). U 06/MF A01.

There are some results of measurements carried out on the wet cooling tower 275 MW(e) at TE Sostanj and on the experimental cooling tower at Jozef Stefan Institute, as well. They are including: the measurements of the output air conditions, the measurements of the cross current of water film and vapour-air flowing through two plates, and the distribution of velocity in boundary layer measured by anemometer.

51558 (LA—7891-MS) **Tomographic visualization of stress corrosion cracks in tubing.** Morris, R.A.; Kruger, R.P.; Wecksung, G.W. (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 10p. P 02/MF A01.

A feasibility study was conducted to determine the possibility of detecting and sizing cracks in reactor cooling water tubes using tomographic techniques. Due to time and financial constraints, only one tomographic reconstruction using the best technique available was made. The results indicate that tomographic reconstructions can, in fact, detect cracks in the tubing and might possibly be capable of measuring the depth of the cracks. Limits of detectability and sensitivity have not been determined but should be investigated in any future work.

51559 (NUREG/CR—0910) **Pattern recognition methods for acoustic emission analysis.** Doctor, P.G.; Harrington, T.P.; Hutton, P.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1979. Contract EY-76-C-06-1830. 58p. (PNL—3052). P 04/MF A01.

Models have been developed that relate the rate of acoustic emissions to structural integrity. The implementation of these techniques in the field has been hindered by the noisy environment in which the data must be taken. Acoustic emissions from noncritical sources are recorded in addition to those produced by critical sources, such as flaws. A technique is discussed for prescreening acoustic events and filtering out those that are produced by noncritical sources. The methodology that was investigated is pattern recognition. Three different pattern recognition techniques were applied to a data set that consisted of acoustic emissions caused by crack growth and acoustic signals caused by extraneous noise sources. Examination of the acoustic emission data presented has uncovered several features of the data that can provide a reasonable filter. Two of the most valuable features are the frequency of maximum response and the autocorrelation coefficient at Lag 13. When these two features and several others were combined with a least squares decision algorithm, 90% of the acoustic emissions in the data set were correctly classified. It appears possible to design filters that eliminate extraneous noise sources from flaw-growth acoustic emissions using pattern recognition techniques.

51560 **Protective tubes for sodium heated water tubes.** Essebaggers, J. (to Dept. of Energy). US Patent 4,140,176. 20 Feb 1979. Filed date 26 Mar 1973. 6p.

PAT-APPL-345,043.

A heat exchanger in which water tubes are heated by liquid sodium which minimizes the results of accidental contact between the water and the sodium caused by failure of one or more of the water tubes is described. A cylindrical protective tube envelopes each water tube and the sodium flows axially in the annular spaces between the protective tubes and the water tubes.

51561 **Ceramic end seal design for high temperature high voltage nuclear instrumentation cables.** Meiss, J.D.; Cannon, C.P. (to Dept. of Energy). US Patent 4,139,724. 13 Feb 1979. Filed date 13 Oct 1977. 4p.

PAT-APPL-841,775.

A coaxial, hermetically sealed end structure is described for electrical instrumentation cables. A generally tubular ceramic body is hermetically sealed within a tubular sheath which is in turn sealed to the cable sheath. One end of the elongated tubular ceramic insulator is sealed to a metal end cap. The other end of the elongated tubular insulator has an end surface which is shaped concave relative to a central conductor which extends out of this end surface. When the end seal is hermetically sealed to an instrumentation cable device and the central conductor is maintained at a high positive potential relative to the tubular metal sheath, the electric field between the central conductor and the outer sheath tends to collect electrons from the concave end surface of the insulator. This minimizes breakdown pulse noise generation when instrumentation potentials are applied to the central conductor.

51562 **Detection and monitoring of defects in pressure vessels.** Whiting, A.R. (Southwest Research Inst., San Antonio, TX). pp 613-620 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

The application of nondestructive evaluation (NDE) techniques to nuclear pressure vessels of nuclear power plant systems has spawned the development of numerous items of remotely-controlled mechanized examination equipment. This equipment is utilized during the initial or preservice examination (PSI) and subsequent inservice examinations (ISI) to meet the American Society of Mechanical Engineers' (ASME) Boiler and Pressure Vessel Code requirements for these vessels. A discussion of the application of ultrasonic examinations to selected regions of the nuclear pressure boundary of reactor systems for detecting and monitoring defects in these systems is given.

51563 **Development of an ultrasonic imaging system for inspection of nuclear reactor pressure vessels.** Becker, F.L.; Crow, V.L.; Crowe, J.C.; Davis, T.J.; Hildebrand, B.P.; Posakony, G.J. (Battelle-Northwest, Richland, WA). pp 621-632 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Pressure vessels are designed in accordance with strict criteria and are inspected to exacting (ASME) boiler and pressure vessel codes (BPVC). Pressure vessels are fabricated from curved steel plates which are welded together to form the primary pressure boundary. Initial acceptance of the weld integrity of these structures is currently based on radiographic nondestructive testing procedures. However, once placed in service, radiographic procedures are no longer applicable as the hostile radioactive environment and physical restrictions preclude duplication of the procedure used during the initial acceptance of the pressure vessel. The ASME Section XI (Inservice Inspection) defines the ultrasonic procedures required for monitoring the weld integrity during the 40-year service cycle of the pressure vessel. Present practice calls for an ultrasonic baseline inspection of all welds in the pressure vessel prior to placing the vessel in service. Once in service, selected sections of weld are reinspected at periodic intervals following a sequence which insures inspection of all welds within a 10-year period. A program to develop an advanced means for rapid and accurate inspection of welds in nuclear reactor pressure vessels is described.

51564 **Stress analysis of nuclear power plants reactor components. Fuel rods, pressure vessels, containment.** Alujeiv, A. pp 1-10 of Mechanical engineering energetic. Beograd; Masinski Fakultet Univerziteta u Beogradu (1977). (In Slovenian)

From Symposium of mechanical engineering energetic; Beograd, Yugoslavia (1 Dec 1977).

During the nuclear reactor operation, one of the most important limiting factors in fuel element duty is the mechanical iteraction of fuel and clad. This interaction produces cyclic stresses and strains in the cladding, and these in turn consume clad fatigue life. It is expected, that compressive hoop stress at the clad ID reaches 14500 psi (100 MPa=MN/m^2, ie. 1000 bar). Tensile stresses could be created once the clad has come in contact with the fuel pellet, approximately after 15000 hours in the reactor core. Reactor pressure vessel is also being exposed to high mechanical load and to an intensive neutron flux irradiation. During the life time of the NPP, this leads to a gradual deportant in the event of LOCA (Loss of Coolant Accident) with action of ECCS (Emergency Core Cooling System), and thus with an instant vessel temperature drop. The reactor containment has to comprise relatively high pressure developed during the accidental fluid release from the reactor piping. The steel structure is additionally loaded by a crane circular rail under the dome, and the strength and stability analyses prove to be very difficult.

51565 **Measurements of the inital rate of depressurization following pneumatic rupture of pipes containing defects.** Baum, M.R.; Butterfield, J.M. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp F4/4 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51566 **Application of anisotropic elasticity to centrifugally cast piping.** Dewey, B.R.; Adler, L.; King, R.T.; Cook, K.V. (Oak Ridge National Lab., TN (USA)). pp F1/4 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51567 **Verification of a loop isolation valve body analysis.** Dietrich, D.E. (Westinghouse Electric Corp., Cheswick, PA (USA)). pp F2/3 1-16 of Structural mechanics in reactor technology. Vol. F.

Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

A three dimensional finite element valve body analysis was verified using comparison of data with experimental strain gauge results. This verification was a requirement of Code Case 1552, Valve Design by Analysis, of the ASME Section III Boiler and Pressure Vessel Code. The internal pressure and design piping load analyses were used for this verification. One half scale experimental and analytical models were employed for the project. The material for both models was an aluminized epoxy, Modeltech 20. Strain gauge results from the pipe loadings and internal pressure were compared with the 3-D finite element strains. This comparison of results was the basis of the verification for the full scale finite element analysis.

51568 Fracture dynamics of a propagating crack in a pressurized ductile cylinder. Emery, A.F.; Love, W.J.; Kobayashi, A.S. (Washington Univ., Seattle (USA). Dept. of Mechanical Engineering). pp F7/2 1-10 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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A suddenly-introduced axial through-crack in the wall of a pipe pressurized by hot water is allowed to propagate according to Weiss' notch-strength theory of ductile static fracture. The dynamic-fracture criterion used enabled the authors to obtain a unique comparison of the results of ductile-fracture with those of brittle-fracture in a fracturing A533B steel pipe. Since the pipe cross-sectional area is likely to increase with large flap motions under ductile tearing, a large deformation shell-finite-difference-dynamic-code which includes rotary inertia was used in this analysis. The uniaxial-stress-strain curve of A533B steel was approximated by a bilinear-stress-strain where Von-Mises yield criterion and associated flow rule were used in the elastic-plastic analysis. The fluid pressure was assumed constant and thus pipe flaps are only lightly loaded by pressure in this analysis.

51569 Investigation of fluidelastic instabilities in tube banks subjected to fluid cross-flow. Franklin, R.E. (Oxford Univ. (UK). Dept. of Engineering Science); Soper, B.M.H. (UKAEA, Harwell. Atomic Energy Research Establishment). pp F6/7 1-14 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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The experimental and theoretical work summarised here is part of a continuing general study of heat exchanger tube vibration, and is concerned with the particular problem of the self-excited, steady-state vibrations of arrays of tubes in cross-flow. The basic experimental work is the measurement, using strain gauges, of the motions of tubes located in the front, centre and back rows of a 10 row array. The Perspex tubes are of 1 inch diameter and are mounted in a cantilevered configuration in a wind tunnel of square working section. The theoretical work is a study of the implications which follow when Connors' approach to the instability problem is applied to configurations more typical of heat exchanger practice. It is shown that in the case of single-span tubes which receive the cross-flow over the whole span, the mode-shape is unimportant, a result which seems to disagree with earlier work. Calculations have also been made for the case of a multi-span tube with partial admission in the first and last bays, and here it is found that the critical velocity can be strongly influenced by conditions in the end bays. The results are believed to be new. Further experimental work is concerned with verification of the theoretical results on the effect of mode shape and partial admission and of initial turbulence.

51570 Finite element analysis of thin and thick walled tubular tee joints. Gantayat, A.N. (Engineering Decision Analysis Company Inc., 480 California Avenue, Berkeley, California 94720, U.S.A.); Powell, G.H. (California Univ., Berkeley (USA)). pp F1/1 1-19 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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In this paper a finite element procedure and the associated computer programs for the analysis of thin and thick walled tubular tee joints under a variety of mechanical and thermal loads are described. The analyses were intended particularly for ASA B16.9 standard tees, used in nuclear power plant piping systems. However, the resulting programs are applicable for a much wider range of tee joint geometries. In order to perform an effective analysis of tee joints by the finite element method, several problems are investigated, including: (1) characteristics of different types of relevant finite elements; (2) procedure for automated generation of finite element data; and (3) the computational efficiency of the computer programs used in the analysis. Descriptions of three computer programs are presented for: (1) stress analysis under arbitrary mechanical load, (2) transient heat flow analysis, and (3) thermal stress analysis for temperature distributions determined from heat flow analysis. Results of typical analyses applicable to both thin as well as thick walled tees are presented.

51571 General purpose computer program for analysis of nuclear power plant piping systems. Ghose, A.; Wais, E.A. (EDS Nuclear Inc., 220 Montgomery Street, San Francisco, California 94104, U.S.A.); Powell, G.H. (California Univ., Berkeley (USA)). pp F2/2 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51572 Vibrations of tube arrays in transversal flow. Gibert, R.J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. des Etudes Mecaniques et Thermiques); Chabrerie, J. (Societe Fives-Cail-Babcock, 80 rue Emile Zola, F-93123 La Courneuve, France); Sagner, M. (Societe Bertin et Compagnie, 78 - Plaisir (France)). pp F6/3 1-13 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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The vibrations induced in tube arrays by a transversal flow are of great practical interest because of their destructive effects especially on heat exchangers. Though turbulence can significantly excite the tubes by itself, most intense vibrations are still caused by two fluidelastic phenomena: The 'lock-in' effect: The basic phenomenon consists of a generation and a synchronization of vortex shedding by a transversal tube motion when its frequency approaches the shedding frequency and when its level is large enough. The so modified vortex shedding generates much more intense vibrations. The whirling instability: In a tube row or a bundle, quasi-steady forces are generated by the displacements of the tubes in flow field. Adjacent tubes are disymmetrically coupled by these forces and instability can appear beyond a critical flow velocity. The study described in this paper gives important information concerning characteristic parameters about both phenomena, in the case of tube arrays. The work is mainly an experimental one though models are also developed.

51573 Flow induced vibrations of piping. Gibert, R.J.; Axisa, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. des Etudes Mecaniques et Thermiques). pp F6/4 1-11 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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In order to design the supports of piping systems, estimations of the vibrations induced by the fluid conveyed through the pipes are generally needed. For that purpose it is necessary to calculate the model parameters of liquid containing pipes. In most computer codes, fluid effects are accounted for just by adding the fuid mass to the structure. This may lead to serious errors.- Inertial effects from the fluid are not correctly evaluated especially in the case of bended or of non-uniform section pipes. Fluid boundary conditions are simply ignored. - In many practical problems fluid compressibility cannot be negelcted, even in the low frequencies domain which corresponds to efficient excitation by turbulent sources of the flow. This paper presents a method to take into account these efects, by solving a coupled mechanical acoustical problem: the computer code TEDEL of the C.E.A./D.E.M.T. System, based on the finite-elements method, has been extended to calculate simultaneously the pressure fluctuations in the fluid and the vibrations of the pipe.

51574 Experimental study of peripheral problems related to liquid flow induced vibration in heat exchangers and steam generators. Gorman, D.J. (Ottawa Univ., Ontario (Canada)). pp F6/2 1-13 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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It has been demonstrated in a convincing fashion by the author that liquid turbulence, some vortex shedding at bundle inlet tubes, and hydroelastic instability are the main causes of vibration in bundles of current interest. Hydroelastic instability thresholds can be fairly well predicted. There are many ways in which real prototype heat exchangers deviate from laboratory tube bundles. In the work reported here, numerous experimental tests have been conducted to determine the effect on permissible design velocity limits of these deviations. All tests have been conducted in a horizontal water tunnel containing tube bundles of contemporary interest. Tests have been conducted to determine whether or not open tube lanes will serve to trigger hydroelastic instabilities at abnormally low velocities. It is found that, in fact, they do not. Further tests were

conducted to investigate the effect of varying the clearance between the bundle and the tunnel wall. The effects on vibration of various shapes of baffle plates located along the tunnel wall was investigated. Preferred baffle plate designs have been established. Mixed bundles of tubes of different frequencies were tested. The effects of locating baffles in the bundle inlet region were studied experimentally. It will be appreciated that all of the results reported are immediately applicable in the design of modern heat exchangers and steam generators.

51575 Non-axisymmetric behaviour of a thermally loaded model tubesheet. Hamerski, B.; Bazergui, A.; Dubuc, J. (Ecole Polytechnique, Montreal, Quebec (Canada). Dept. de Genie Mecanique). pp F9/2 1-12 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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The analysis of tubesheet assemblies is presently almost exclusively carried out by neglecting the effect of the solid separation(s) between the different perforated zones (e.g. diametral lane). The problem is thus transformed into an axisymmetric one and equivalent elastic constants are used for the perforated zone. The above approximation is necessarily conservative since it does not take into account the following two possible effects: (1) increased local rigidity due to the presence of a lane of unperforated material with resulting high levels of local stresses. (2) non-axisymmetric displacements of the tubesheet periphery which may induce local loss of contact at the gasket and result in a leaky joint. The purpose of the paper is to report on an experimental investigation carried out with an epoxy resin model of a tubesheet with two passes and a wide diametral lane. Various thermal loading configurations both symmetric and non-symmetric have been applied and, in addition, the effect of rate of temperature increase has been studied.

51576 Experimental verification of U-bolt connection for pipe whip restraint design. Heckhauser, H. (Babcock - Brown Boveri Reaktor G.m.b.H., Mannheim (Germany, F.R.)); Chen, C.; Sarnes, F.W.; Shanmugasundaram, R. (Gilbert/Commonwealth, Reading, PA (USA)). pp F3/5 1-13 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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For pipe whip restraints, to prevent the broken pipe from damaging other safety class equipment, ductile material is used for the restraint structure so that large plastic deformation is utilized to absorb the released energy from the pipe. One of the most efficient and the simplest restraints is the steel U-bolt system which requires the pin and clevis for connection to the embedment plate. This system is not only expensive but also requires that embedment plate be designed to take tension. However, it simplifies the analysis such that only tension deformation is considered in the U-bolt. This tension only deformation is important , because the acceptable deformation criterion in the ANSI N176 Standard 'Design Basis for Protection of Nuclear Power Plants against Effects of Postulated Pipe Rupture', is 50 percent of the minimum ultimate 'uniform' strain. As an alternative, an anchor bearing plate system is presented, which was developed for the U-bolt connection. Since this connection is not free to rotate, tension and bending deformations in the U-bolt have to be considered simultaneously. The first problem encountered is to determine the acceptable deformation criterion in compliance with the aforementioned ANSI N176 Standard.

51577 Effects of support clamps on elevated temperature piping. Hyde, L.L.; Wagner, S.E. (Hanford Engineering Development Lab., Richland, WA (USA)). pp F1/7 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51578 Improved procedures for pipe rupture analysis. Jones, L.R.; Row, D.G.; Mondkar, D.P. (COMPUTECH, 2150 Shattuk Avenue, Berkeley, California 94704, U.S.A.). pp F3/7 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51579 Stress distributions of an elbow with straight pipes. Kano, T.; Iwata, K. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)); Asakura, J.; Takeda, H. (Century Research Center Corporation, 6-4, 2-Chome, Nihonbashi Honmachi, Chuo-ku, 103, Japan). pp F1/5 1-11 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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The present paper investigates three-dimensional elastic analyses of an elbow with straight pipes under in-plane or out-of-plane bending moment, using three different types of models in commercially available general purpose computer programs. A post-processor for output plotting is developed to assist understanding of the stress distributions over the surfaces of the elbow and straight pipes. The elbow with straight pipes is fixed at one end, and, at the other end, subjected to loads corresponding to in-plane or out-of-plane bending, moment. Three differential models (quadrilateral thin shell elements in the ANSYS program, quadrilateral higher code solid elements in the ASKA program, and the combination of elbow and beam elements in the MARC program) were used to obtain reasonably accurate solutions of these problems and also to assess the validity of these approximations. Analyses were performed with well refined meshes in all cases.

51580 Inelastic dynamic analysis of piping systems. Killian, D.E.; Yoon, K.E. (Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Generation Div.). pp F2/1 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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51581 Influence of multiple loadings to plastic pipe elements. Applications to the pipe whip problem. Lazzeri, L. (SAIGE S.p.A. Pesce, 5, I-16151 Genova-Sampierdarena, Italy). pp F3/2 1-11 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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The aim of this paper is a contribution to the study of the pipe whip accident considering various effects (pressurization, presence of bending in two normal planes, shears, torque, normal force) which have been previously neglected by the author in precedent work on the same subject for simplicity reasons. A model for a strain hardening plastic pipe element has been proposed. Two models, a strain model and a mixed model are compared in terms of the results which may be obtained by the use of each of them: the result is that in the cases investigated the differences are not large in terms of curvature changes (while it may be somewhat more important in terms of the shear strains).

51582 Gapped restraints and pipe whipping. Lee, K.N.; Hollmeier, R.J. (Fluor Pioneer, Inc., Chicago, IL (USA)). pp F4/2 1-15 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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Due to the type of rupture forces and the distribution of pipe whip restraints, four posible responses may occur in the analysis of the interaction of gapped restraints and pipe shipping. These responses may be characterized by the current state of the component's material properties as follows: (1) All of the pipe cross sections and gapped restraints are in the elastic region. (2) Some of the pipe cross sections and gapped restraints are in the plastic region. (3) All of the pipe cross sections are in the elastic region, while some of the gapped restraints are in the plastic region. (4) Some of the pipe cross sections are in the plastic region, while all of the gapped restraints are in the elastic region. In this presentation, a quadratic yield surface has been used to cope with the resultant forces. A numerical step-by-step integration, together with the initial force iterative scheme has been accordingly incorporated to conduct nonlinear dynamic plastic analysis of piping systems with initially gapped restraints. In this manner, a computer program, DYNPLA, has been developed and is capable of conducting all the four possible responses in the interaction of pipe whipping and gapped restraints. The effectiveness and comprehensiveness of the DYNPLA program is demonstrated by the results of various sample problems presented in this paper.

51583 Dynamic crack propagation in two- and three-dimensional solids. Owen, D.R.J.; Shantaram, D. (University Coll. of Swansea (UK)). pp F7/5 1-13 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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This paper describes a numerical approach to the prediction of crack propagation in two- and three-dimensional structures. The work is primarily aimed at the analysis of dynamic crack growth in pressurised pipe lines. A cylindrical pipe is considered in which a crack is assumed to propagate along a generator. Large deformation effects must be accounted for in order to simulate the gross geometrical changes which occur in the crack in zone. Loss of pressurization in regions behind the crack tip must also be considered. An

understanding of the fracture processes in such a system is essential for arriving at meaningful fracture arrest conditions. Two general approaches are open: (a) A limiting crack tip stress for propagation can be postulated, or (b) an energy rate balance criterion can be adopted. In the present study the finite element method is employed for model simulation. The computer code developed is firstly checked by applying to the standard double cantilever beam problem of fracture mechanics; both a stress and energy balance criterion are adopted. The problems of both a stationary and a propagating crack in a pressurised pipline are then numerically solved for.

51584 Local crush rigidity of pipes and elbows. Peech, J.M.; Roemer, R.E.; Pirotin, S.D.; East, G.H.; Goldstein, N.A. (Stone and Webster Engineering Corp., Boston, MA (USA)). pp F3/8 1-12 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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Engineering evaluations of postulated pipe ruptures sometimes require a knowledge of the local cruch rigidity of straight pipes and elbows. However, little data is available, so an experimental and theoretical study was conducted to determine the quasi-static local crush stiffness of piping. Applications include the evaluation of displacement limiting bumpers, low velocity impacts and a novel energy absorbing restraint. The experiments provided force-deflection curves and scaling laws for several configurations. The scaling law for the simplest geometry, a ring, was compared to computer evaluations and proved acceptable well beyond the range of experiment. This comparison also justifies analytical techniques for investigating varibility due to material, temperature, internal pressure, and loading geometry.

51585 Pipe elbow stiffness coefficients including shear and bend flexibility factors for use in direct stiffness codes. Perry, R.F. (United Engineers and Constructors, Inc., Philadelphia, PA (USA)). pp F1/2 1-17 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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Historically, developments of computer codes used for piping analysis were based upon the flexibility method of structural analysis. Because of the specialized techniques employed in this method, the codes handled systems composed of only piping elements. Over the past ten years, the direct stiffness method has gained great popularity because of its systematic solution procedure regardless of the type of structural elements composing the system. A great advantage is realized with a direct stiffness code that combines piping elements along with other structural elements such as beams, plates, and shells, in a single model. One common problem, however, has been the lack of an accurate pipe elbow element that would adequately represent the effects of transverse shear and bend flexibility factors. The purpose of the present paper is to present a systematic derivation of the required 12x12 stiffness matrix and load vectors for a three dimensional pipe elbow element which includes the effects of transverse shear and pipe bend flexibility according to the ASME Boiler and Pressure Vessel Code, Section III. The results are presented analytically and as FORTRAN subroutines to be directly incorporated into existing direct stiffness codes.

51586 Large deflection, elastic-plastic response of piping: experiment, analysis and application. Pirotin, S.D.; East, G.H.Jr (Stone and Webster Engineering Corp., Boston, MA (USA)). pp F3/1 1-11 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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The effects of postulated high-energy pipe rupture must be evaluated in the design of nuclear power plants. Methods for evaluating one aspect of this accident, pipe whip, and restraint impact, require solutions based on non-linear inelastic dynamics. Since no suitable analytical techniques or computer programs were then available, Stone and Webster undertook the development of such a capability. An important phase of this effort was an experimental program to justify the adequacy of the computer code. The results of these experiments and a comparison with analytical predictions are provided.

51587 Inelastic pipe elements for analysis of pipe whip. Powell, H. (California Univ., Berkeley (USA)). pp F3/6 1-10 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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The production of economical and safe designs for pipe whip restraints requires inelastic dynamic analysis of the piping under a time-varying force at the rupture location. In this analysis, it is important to recognize that the pipe may be subject to torsional moment plus bending moments about two axes, and that correct modelling of the system requires that interaction among these moments be considered. The purpose of this paper is to compare two alterntive assumptions for the effects of moment interaction following yeilding of the pipe.

51588 Design and analysis procedure for simple ASME Section III Class 2 and 3 piping systems. Rigamonti, G.; Rich, S.E. (United Engineers and Constructors, Inc., Philadelphia, PA (USA)). pp F2/7 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51589 Experimental and simulation studies of a 3-dimensional heat exchanger tube with baffle interaction. Rogers, R.J.; Pick, R.J. (Waterloo Univ., Ontario (Canada). Dept. of Mechanical Engineering). pp F6/6 1-6 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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Vibration of heat exchanger tubes can result in fretting wear at baffle supports. Earlier work described a finite element technique for simulating tube response with baffle interaction and gave experimental confirmation primarily for planar motion with short duration impacts. This paper presents a comparison of results from an improved, 3-dimensional tube apparatus and a refined computer program. The authors are not aware of any other technique which simulates the 3-dimensional response of intermittently contracting structures. The optimum finite element model consisted of seven beam elements. Concentrated masses, torsional inertias and diametral inertias were included to model the experimental apparatus. The tube/annulus stiffness was determined by comparing the rise time of the simulated impact force to that observed experimentally. The tube behaviour was simulated by numerically integrating the equations of motion resulting from the finite element mode. The sensitivity of the model to a number of parameters has been investigated.

51590 Limit moments for non circular cross-section (elliptical) pipe bends. Spence, J. (Strathclyde Univ., Glasgow (UK). Dept. of Mechanics of Materials); Findlay, G.E. (Paisley Coll. of Technology (UK)). pp F1/6 1-10 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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A number of experiment studies have been reported or are underway which investigate limit moments applied to pipe bends. Some theoretical work is also available. However, most of the work has been confined to nominally circular cross-section bends and little account has been taken of the practical problem of manufacturing tolerances. Many methods of manufacture result in bends which are not circular in cross-section but have an oval or elliptical shape. The present paper extends previous analyses on circular bends to cater for initially elliptical cross-sections. The loading is primarily in plane bending but out of plane is also considered and several independent methods are presented. No previous information is known to the authors. Upper and lower bound limit moments are derived first of all from existing linear elastic analyses and secondly upper bound moments are derived via a plastic analogy from existing stationary creep results. It is also shown that the creep information on design factors for bends can be used to obtain a reasonable estimate of the complete moment/strain behaviour of a bend or indeed a system.

51591 Pipe rupture and steam/water hammer design loads for dynamic analysis of piping systems. Strong, B.R. Jr.; Baschiere, R.J. (Advanced Analysis Division, EDS Nuclear Inc., 220 Montgomery Street, San Francisco, California 94104, U.S.A.). pp F4/3 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51592 Analysis of leakage areas in pipes. Theuer, E. (Kraftwerk Union A.G., Erlangen (Germany, F.R.). Hauptbereich Reaktortechnik); Ayres, D.J. (Combustion Engineering, Inc., Windsor, CT (USA)). pp F7/7 1-14 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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In order to facilitate a realistic approximation of jet forces due to longitudinal cracks in pipes under pressure and its variation with time, exact calculations of leakage and cracks border form during opening, are required. Complex phenomena of dynamic plastification and depressurization of the system have to be taken into consideration. The opening areas of longitudinal cracks are computed by an

elastic-plastic large displacement dynamic finite element analysis using in the general purpose program MARC. Results of these analyses are compared with experimental data. Plots showing the variation with time of displacements and stresses are presented. Three finite element models, from simple to complex geometries, are presented. Changing boundary conditions and time steps are explained. Fracture mechanics parameters (J-integral) are computed around the crack tip. These values are compared with experimental data in order to show the tendency pf the crack to propagate or to arrest. The longest stable crack is calculated for each Finite Element Model. Elastic-plastic dynamic phenomena of a running crack in a pipe under pressure are presented, and its computation with an elastic-plastic large displacement dynamic finite element program is explained.

51593 Experimental analysis of an energy absorber for steam pipe restraint. Vrillon, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)); Monnier, B. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Courbevoie (France)). pp F3/4 1-13 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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This analysis is relative to a new high energy crushing dissipator device. This element is settled by a metal circular tube with circular holes, regularly distributed on its lateral surface. The working mode for this tube is axial crushing. Experimental results were complemented by calculations employing the finite element method in elastic-plastic regime, using large elongation and deformation modes.

51594 Fracture mechanics investigations of cracks in rotating discs. Wenk, M. (Technischer Ueberwachungs-Verein Norddeutschland e.V., Hamburg (Germany, F.R.)). pp F2/10 1-14 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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Many engineering constructions such as turbines, pumps or fly-wheels, involve the use of fast rotating components. To optimize their dimensions and to ensure safety in service a precise knowledge of their strength under centrifugal loading is necessary. Recently, attempts have been made to apply the methods of fracture mechanics to this field as these have proved successful in solving other problems of strength and safety. These methods should provide a means of determining limiting loads for rotating parts if cracks or cracklike defects are present. In this work the applicability and the limitations of linear elastic fracture mechanics under conditions of centrifugal loading are investigated using the simple case of rotating solid disc. The method discussed is applied to the flywheel of a coolant pump and the results presented.

51595 Consistent approach for the analysis of buried pipes. Widera, G.E.O.; Kitz, G.T.; Lan, J.S. (Sargent and Lundy, Chicago, IL (USA)). pp F2/8 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51596 Piping shear lug stress analysis. Widera, G.E.O.; Kitz, G.T.; Verma, V.K.; Lan, J.S. (Sargent and Lundy, Chicago, IL (USA)). pp F2/9 1-9 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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Due to space limitations present in many of the current nuclear power plants, it is frequently necessary to apply restraints skewed to a piping system's axis in order to restrain the piping against hydraulic transient and seismic loads. In order to assuure that the restraints function as required, shear lugs are often used to eliminate relative motion between the pipe and the restraint. The design of these lugs must be such that the stresses induced in the pipe are in compliance with the criteria of the ASME Code. According to the Code, stresses may be determined by either a detailed stress analysis or by use of given simplified analysis procedures employing stress indices. At present, stress indices are not provided for lugs. It is the purpose of this paper, to present detailed stress analyses of the pipe-lug system and from them deduce expressions for the needed indices. The analyses are accomplished through use of three-dimensional finite-element modeling employing the computer program SAP IV.

51597 Effective elastic constants for perforated plates with square penetration patterns. Yu, I.-W.; Gabrielse, S.E. (Westinghouse Research Labs., Pittsburgh, PA (USA)). pp F9/4 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

FUEL ELEMENTS

REFER ALSO TO CITATION(S) 51653, 51981, 51993, 52002, 52003, 52004

51598 (AERE-R—9178) **Dependence of evolving cavity distribution functions on the growth kinetics.** Wood, M.H.; Hayns, M.R. (UKAEA, Harwell. Atomic Energy Research Establishment). Jul 1978. 17p. U 02/MF A01; Also available from H.M. Stationery Office, price Pound1.00.

The growth of cavities within nuclear reactor structural materials and nuclear fuel, during irradiation, gives rise to the swelling of structural components and fuel pins, with consequences for reactor performance. In this study we describe how experimental observations of evolving cavity distribution functions, coupled to simple analyses, could lead to information about the cavity growth kinetics.

51599 Fracture of Zircaloy cladding as a consequence of power increases in water reactor fuel rods. Ranjan, G.V. (Failure Analysis Associates, Palo Alto, CA (USA)); Smith, E. (Manchester Univ. (UK). Dept. of Metallurgy). pp C2/1 1-11 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The objective of this theoretical investigation is to further understanding of the fracture of Zircaloy cladding by interactions with Uranium Dioxide fuel pellets in water reactor fuel rods, as a consequence of a power increase after a sufficiently high burn-up. To accommodate the thermal expansion in the outer regions of the fuel pellets, radial cracks form within the fuel, and the Zircaloy cladding deforms in response to the fuel expansion, stress corrosion cracks forming and growing within the cladding in the vicinity of the fuel pellet cracks; these lead to cladding failure and iodine is generally regarded as being one of the active chemical species. The investigation is based on the development and analytical solution of simplified models that represent the formation and growth of the Zircaloy stress corrosion cracks, but the analyses are also supported by finite element studies where appropriate. The initial results from the investigation were presented at the recent ASTM Conference on Zirconium in Nuclear Applications, Quebec City, August 1976. Recent extensions of this work are described.

51600 (JAERI-M—7716) **Calculation of stress intensity factor at crack tip. Preliminary calculation by FEM and LFM for analysis of PCI experiment.** Kikuchi, A.; Fujita, M. (Japan Atomic Energy Research Inst., Tokyo). Jun 1978. 44p. (In Japanese). U 04/MF A01.

Knowledge of the crack propagation behavior in the Zircaloy cladding is important in analysis of LWR fuel-PCI (pellet-cladding interaction). The most essential is then calculation of the stress intensity factor at crack tip. The region of analysis was set on the transversal cross section of Zircaloy cladding including a crack. The stress distribution under plane stress condition and the stress intensity factor were continuously calculated by finite element method (FEM) and by linear fracture mechanics (LFM) respectively. Described are the calculated results of equivalent stress distribution in the analytical region, nodal displacement at the crack tip, correlation between crack length and energy release rate, correlation between crack length and stress intensity factor, and influence of inner pressure on the stress intensity factor, in the two cases of constant inner pressure and distributed inner pressure. For the next phase of study, useful information could be obtained.

51601 (STUDSVIK-BL—78-4) **Fission product migration in intact fuel rods. S176 experiments 1-5: Axial gamma scanning results.** Blackadder, W.; Forsyth, R.; Malen, K.; Nilsson, Bengt-Aake. (Aktiebolaget Atomenergi, Studsvik (Sweden)). Mar 1978. 34p. U 03/MF A01.

This report is the fifth of a group which present the results obtained during the first 5 experiments in the S176 series of irradiation experiments. The aim of this series is to provide information on the distribution of fission products in intact irradiated fuel rods, both within the UO_2 fuel and on the inside of the Zircaloy clad. Fuel rods, previously irradiated to appreciable burnups in the Aagesta R3 reactor, after cooling, are re-irradiated in the Studsvik R2 test reactor for short periods to build up significant inventories of short-lived fission products of interest. Examination of sections of fuel and clad is performed within a short time after removal from the reactor.

51602 (STUDSVIK-RL—78-47) **Electrically heated fuelrod simulator.** Dillner, G. (Aktiebolaget Atomenergi, Studsvik (Sweden)). May 1978. 9p. (In Swedish). U 02/MF A01.

The rod is direct-heated, and conceived for experiments to measure heat transfer at the post-dryout phase after blowdown, until start of the sprinklers.

51603 Behaviour of fission gas in oxide fuels in a transient overpower. Wehner, T.; Eggen, D.T. (Northwestern Univ., Evanston, IL (USA). Technological Inst.). pp E3/10 1-4 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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The purpose of this paper is to describe the effects of fission gas on fuel and fuel motion from the initiation of a transient overpower (TOP) to fuel pin failure. This paper does not deal with fuel motion after fuel pin failure or with the reactivity of the fuel but reports only the thermal response of oxide fuel during a TOP. A fuel pin can be categorized according to its most advanced fuel microstructure. In low-power irradiated fuel pins the fraction of fission gas in the fuel is greater at the top and bottom than at the midplane of the fuel pin. A high-power irradiated fuel pin has a high-power irradiated fuel microstructure at the axial midplane and a low-power irradiated fuel microstructure near the top and bottom of the fuel pin. The axial distribution of fission gas is peaked at the top and bottom of the fuel pin while the midsection contains a minimum amount of fission gas. During a TOP three cladding loading mechanisms may operate, fuel thermal expansion, fuel volumetric expansion and transient fission gas release. Fuel pin failure in a TOP is dependent upon fuel microstructure and concentrations of retained fission gas. After fuel pin failure fission gas can act as a driving force to eject molten fuel from the fuel pin.

51604 Deformation and failure analysis in the FRAP fuel rod codes. Berna, G.A.; Bohn, M.P.; Coleman, D.R.; Dearien, J.A.; Kerrigan, J.D.; Siefken, L.J. (EG and G Idaho, Inc., Idaho Falls (USA)). pp D1/9 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51605 Transient non-boiling heat transfer in a fuel rod bundle during accidental power excursions. Bonaekdarzadeh, S; Johannsen, K.; Ramm, H. (Technische Univ. Berlin (Germany, F.R.). Inst. fuer Kerntechnik). pp 4/3 1-14 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

One important aspect in analysis of the unprotected transient overpower accident is the prediction of time and location of fuel pin failure. The accuracy of such predictions decisively depends of the adequate modeling of the heat transfer processes involved. The present investigation focusses on the fundamental heat transfer aspects in the first phase of the power-excursion transient before boiling of the coolant starts, by solving the four coupled three-dimensional time-dependent energy equations for the fuel rod (fuel, gap, clad) and the coolant. The analysis surpasses similar previous studies, e.g. by Gopalakrishnan, in several important aspects. Most notable is that the geometry of the fuel rod bundle is correctly described in its three dimensions and the turbulent energy transport within the coolant is modeled more realistic and in a consistent manner over the entire Prandtl number range of interest using results from a specially tailored phenomenological turbulence model. The physical problem studied is the transient non-boiling heat transfer of a cylindrical fuel rod consisting of fuel, gap, and cladding to a steady, fully developed turbulent flow. A digital computer program has been developed, on the basis of finite-difference techniques, to solve the governing partial differential equations with their associated subsidiary conditions.

51606 Elastic fuel rod deflections and spacer reactors due to transverse temperature gradients. Buttemer, D.R. (General Atomic Co., San Diego, CA (USA)). pp D2/7 1-6 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

Transverse temperature gradients can occur in fuel rods due to power tilts or to thermal-hydraulic variations in the coolant subchannel which surround the fuel rod. Evaluations of the fuel rod deformations and spacer reaction forces associated with thermal gradients occurring during long term power operation involve complex computer analyses which include relaxation effects. During certain transient or accident situations even more severe short term thermal gradients can be developed due to subchannel power-to-flow imbalances wherein the associated elastic fuel rod determinations and spacer reaction forces are of interest both from a structural and a thermal-hydraulic feedback point of view. This paper evaluates the elastic fuel rod lateral deflections and the spacer reaction forces for a fuel rod subjected to a uniform lateral temperature gradient along its entire length.

51607 Development of criteria for the failure of Zircaloy fuel cladding. Fitch, J.R.; Tomalin, D.S.; Adamson, R.B. (General Electric Co., San Jose, CA (USA). Nuclear Energy Div.). pp C3/9 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51608 Mechanical and temperature contact in fuel rod cladding. Fredriksson, B.E.; Rydholm, S.G. (Linkoepings Hoegskola (Sweden)). pp D3/1 1-14 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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For the mechanical contact between fuel and cladding a slip criterion relating contact shear stresses to the slip between fuel and cladding is introduced. Because of irreversibility an incremental formulation is made. With this slip criterion with associated slip rule it is possible to simulate different types of frictional behaviour of the fuel cladding interface. It is also possible to allow for eventual welding between fuel and cladding. The transient temperature problem is also solved by means of the finite element method. The paper presents results for the effect of different types of slip rules on the contact stress distribution. It is shown that the contact shear stress is smaller for the hardening model than for the ideal model. It is also shown that a crack in the fuel increases the contact stresses and that at temperature decrease high tensile stresses arise after eventual welding. It is also shown how particles between fuel and cladding influence the stresses. Also here the effect of eventual welding is studied.

51609 Validation of in-pile creep-collapse analysis of Zircaloy cladding by direct experiments. Frenkel, J.M.; Weisz, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Recherches Metallurgiques Appliquees); Lemoine, P. (Groupement pour les Activites Atomiques et Avancees (GAAA), 92 - Le Plessis-Robinson (France)). pp v.C p.C1/4 1-12 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The authors have performed in-pile creep-collapse experiments with zircaloy-4 cladding and used two different methods of analysis: The first one is a semi-empirical method based on the use of tangent or reduced modulus and isochronous curves. In this case the clad is assumed to remain perfectly round and collapse occurs when the modulus reaches a critical value. The calculation gives the critical time of creep-buckling. The second is an analytical method, where the clad is treated as a thin shell and its ovalisation resolved into a trigonometric series the factors of which are time dependent. The in pile creep collapse experiments were performed with clads from different batches of zircaloy-4. For each of these batches a complete formulation of in-pile diametral creep was obtained from in-pile experiments on end-closed tubes under internal pressure. The present survey consists in proposing, for each of the two calculation methods, the adjustment required to give a good agreement between the calculations and the experiments. The authors conclusions are as follows: In the case of the first method, the use of tangent modulus seems to produce collapse times, which are obviously too short. If reduced modulus is used, the results are more satisfactory providing the thickness value used is the mean thickness. However, with this method, it is not possible to take into account the initial ovalization, which, in fact, would appear to be a major parameter. In the second method, the influence of the initial ovalization is very marked, as is that of the thickness value adopted.

51610 Analysis of crack patterns in fast reactor fuel pellets. Guha, R.M.; Head, J.L. (Imperial Coll. of Science and Technology, London (UK). Dept. of Mechanical Engineering); Matthews, J.R. (UKAEA, Harwell. Atomic Energy Research Establishment). pp C2/7 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51611 Pressure field propagation and mechanical vibration in a subchannel rig driven by a centrifugal blower. Harris, R.W.; Hooper, J.D. (Australian Atomic Energy Commission Research Establish-

ment, Lucas Heights. Engineering Research Div.). pp D3/10 1-11 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

A six rod rig was built to study the structure of turbulent velocity and pressure fluctuations in a closely spaced square-pitched array of rods. An investigation was made of the spectra of the dynamic pressure and the structure vibration for the 45 kW centrifugal air blower; calming entry drum to the rig; and test section, as a function of Reybolds number, for the range of 10^4 to $2.4x10^5$. The spectra showed that some of the lower frequency pressure components of the blower were propagating through 15 metre of 20 cm diameter ducting to the drum and test section, and exciting mechanical vibration of the test section. Approximate calculations of the possible flexural mechanical resonances of the system indicated that the frequencies contained in the pressure field were near some of the resonances, which would enhance the flow induced vibration. This far field pressure effect was most evident at the lower Reynolds numbers. As the Reynolds number was increased above $1.1x10^6$, a large low frequency peak developed on the pressure spectra of the test section.

51612 Optimal rate of power increase in nuclear fuel pellet behaviour under dynamic conditions. Karlsson, B.G. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden)). pp C2/4 1-11 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

A mathematical model has been developed for the determination of the optimum power escalation rate for nuclear power plants from the view-point of fuel integrity. The model, TRANS, calculates the stress and strain transients in pellet-cladding systems with rapid power increases. No burnup effects are included due to the short time scale involved. An elastic solution has been transposed to a linear viscoelastic one, using the correspondence principle. The cladding has, however, been treated under the programme assumptions as purely elastic. The fuel material has been considered to be completely relaxed prior to the power transient. Radial cracking is included. The UO_2-material distortion has been assumed to be linear viscoelastic, while the dilatation elastic. The system has been treated assuming plane strain. Axial and rotational symmetry was applied. The results of the calculations show that under the above assumptions the cladding strain is independent of the rate of power increase in the pellet. Since this result is in opposition to general opinion, an experimental programme was performed confirming the results.

51613 New version of the LWR fuel performance model WAFER. Kjaer-Pedersen, N. (Elsinore Shipbuilding and Engineering Co. Ltd. (Denmark)). pp D1/3 1-11 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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The latest version, WAFER-2 of the Danish LWR fuel performance code WAFER is discussed. The original version, WAFER-1, has previously been published. Modifications in the new version are: (i) Restrictoons on fuel crack penetration have been completely removed. This implies more accurate stress analysis, hence more realistic, creep calculations. (ii) Several transversal fuel cracks at arbitrary axial locations (as opposed to one at the mid-pellet position in WAFER-1) are now permitted. This further improves stress analysis and renders the pellet model duly sensitive to interaction forces from the cladding. (iii) The total radial crack volume is now evenly distributed circumferentially. This insures better accuracy in the average stress/strain values, at the cost of insignificant local detail. (iv) Elastic moduli and other materials properties are now functions of temperature and other operational parameters. (v) The fundamental mode of calculation has been changed: WAFER-1 calculates time step increments of all system variables, to be added to base values from the proceeding time point. WAFER-2 does an absolute base value calculation at each time point for all non-integrator variables. This change saves storage and reduces error accumulation. (vi) A series of new capabilities has been added to the code: Densification, gaseous swelling and fission gas release. (vii) The treatment of primary creep and yielding of the cladding has been improved.

51614 Cladding failure by local plastic instability. Kramer, J.M.; Deitrich, L.W. (Argonne National Lab., IL (USA)). pp C3/12 1-15 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

Cladding failure is one of the major considerations in analysis of fast-reactor fuel pin behavior during hypothetical accident transients since time, location and nature of failure govern the early post-failure material motion and reactivity feedback. Out-of-Pile transient burst tests of both irradiated and unirradiated fast-reactor cladding show that local plastic instability, or bulging, often precedes rupture. To investigate the details of cladding bulging, a perturbation analysis of the equations governing the large deformation of a cylindrical shell has been developed. The overall deformation history is assumed to consist of a small perturbation epsilon of the radial displacement superimposed on large axisymmetric displacements. Computations have been carried out using high temperature properties of stainless steel in conjunction with various constitutive theories, including a generalization of the Endochronic Theory of Plasticity in which both time-independent and time-dependent plastic strains are modeled. Although the results of the calculations are all qualitatively similar, it appears that modeling of both time-independent and time-dependent plastic strains is necessary to interpret the transient burst test results. Sources for bulge formation that have been considered include initial geometric imperfections and thermal perturbations due to either eccentric fuel pellets or non-symmetric cooling.

51615 Spacers for fuel elements as structural anisotropic plates composed of cylindrical shells. Kuzelka, V. (National Research Institute for Machine Design, SVUSS, 250 97 Prague 9-Bechovice, Czechoslovakia). pp D3/2 1-17 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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Fuel rods are kept at given distances by means of spacer components. During reactor operations the spacers are subject to a number of temperature and force effects which may cause a failure. The quantitative evaluation of theses effects and their consequences is necessary for the elaboration of a successful design of the spacer components. In this paper the results of investigations concerning the state of stress in the spacers which are assumed to be 'structural anisotropic plates composed of cylindrical shells' (below: 'plates' only), as well as the behaviour of the spacers in the interactions with fuel elements are presented. A method is developed whereby the deformations and stresses in mentioned plates can be computed. An application of the developed method-including its experimental verification-from the region of spacers for nuclear reactors is shown. The agreement between the theoretical results and experimental ones is reasonably good.

51616 Iterative model for calculating the crack structure in fuel rod design. Lassmann, K. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Reaktortechnik). pp C1/3 1-12 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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The mechanical behaviour of fuel rods is significantly influenced by the extent of fuel pellet cracking. Due to steady or unsteady power histories, crack growth or crack healing may occur. Especially in power cycling relocation effects are observed and must be considered in normal operation and safety analysis. The model developed to calculate the crack structure is within the scope of the URANUS fuel rod code, which gives a thermal and mechanical analysis of integral fuel rod behaviour. As the fuel rod geometry in the URANUS-code is idealized as a quasi two dimensional description, the model can take local effects into account only by their average values. The basic assumptions of the model are: a) cracks are substituted by means of fictitious crack strains; b) cracks may occur perpendicular to radial, tangential and axial direction. The theory is developed in extension to the classical theory of plasticity. An iterative procedure is given combining plasticity and crack calculation. The results show the importance of a good crack model to fuel rod analysis: the fictitious crack strains are of the same order of magnitude as the thermal strains. Both together give the most dominant influence to the gap conductance. Example calculations are presented for UO_2 and UC under different conditions. During the heat-up phase, radial and axial cracks from the pellet outside to the center are observed while during the heat-down phase cracks from the center to the outside are obtained. During this phase also circumferential cracks are predicted by the model.

51617 URANUS, a computer code for the thermal and mechanical analysis of fuel rod behaviour. Lassmann, K. (Technische Hochschule Darmstadt (Germany, F.R.). Fachgebiet Reaktortechnik). pp D1/2 1-13 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

An exact and complete solution of fuel rod analysis is not possible within the present knowledge. So one has to make assumptions to simplify either the complexity of the state of deformation or the complexity of material behavior, which includes the analysis of only a small section of the fuel rod. The author wants to point out, that both lines of analysis are important and complementary to each other. The URANUS-code follows the first line: a quasi 2d thermal and mechanical integral fuel rod analysis is combined with highly complex material behaviour. The quasi 2d solution has been com-

pared with a 2d-finite element solution. An excellent agreement in the axial friction force distribution was found. The mechanical description takes seven components of strain into account: elastic, time-independent plastic, creep, thermal and strains due to swelling, cracking and densification. Models for temperature distributions heat generation, gap closure, pellet cracking, crack healing, fission gas release, corrosion, O/M distribution and Pu-redistribution are included. In the paper the new basic mechanical concept, which is a superposition of a 1d-radial solution and a 1d-axial solution is given as well as all basic equations. The mechanical concept determines the code structure, which also is shown in detail.

51618 Analysis of the ballooning deformation of an internally pressurized thin-wall tube during fast thermal transients. Lin, E.I.H (Argonne National Lab., IL (USA)). pp C1/5 1-15 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

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The local bulging that precedes the rupture of a tube subjected to internal pressure (and thermal transients) is commonly referred to as ballooning. This mode of deformation commences with the onset of plastic instability in the material and, under certain conditions, culminates in large strains at rupture. A large-strain, time-dependent thermoplastic analysis of ballooning deformation was developed. The true (or logarithmic) strains, the Von Mises yield criterion and Prandtl-Reuss flow rules were used. The constitutive equation was expressed in terms of the temperature, effective stress, strain and strain rate. The thin shell approximation was made, which proved to be adequate for the standard fuel claddings and which was advantageous in that the averaged state of stress was rendered determinate. In order to determine the onset of localized deformation, a plastic-instability criterion was employed. It was found that the local ballooning geometry strongly affects the evolution of the stress state, which in turn determines the flow characteristics as the material itself undergoes microstructural changes throughout the transients. The analysis led to a set of non-linear ordinary differential equations, which was then integrated by a fifth-order Runge-Kutta routine. The analysis was applied to Zircaloy claddings subjected to simulated thermal transient conditions.

51619 Pellet-clad mechanical interaction evaluation. Merckx, K.R. (Exxon Nuclear Co., Inc., Richland, WA (USA)). pp D1/5 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51620 CYGRO-4 fuel rod analysis computer program. Newman, J.B.; Giovengo, J.F.; Comden, L.P. (Westinghouse Electric Corp., West Mifflin, PA (USA)). pp D1/1 1-11 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

CYGRO-4 is a finite element computer program for the analysis of axisymmetric deformations of the cross-section of an oxide fuel rod. It is a production program developed from CYGRO-3. Its development has provided a precise, reliable program with up-to-date physical models and a computational structure adapted for easy revision. Significant developments include time step control based on accuracy considerations, a new fuel-clad and rod-support interaction model, a new thermal conductivity model for the fuel-clad gas, and a new fuel cracking crack deformation and crack healing model. Deformation of fuel and clad, the stresses in them and the forces of interaction between fuel and clad and rod and support are computed from a Large Deflection Finite Element model incorporating representations for thermo-elasticity, fuel swelling and densification, fuel cracking and crack healing, clad growth caused by neutron bombardment, and fuel and clad creep resulting from thermally activated mechanisms or mechanisms associated with bombardment by high energy particles. The program accounts for the effects of spatial-as well as temporal-variation of temperature, stress, strain, cracking, and densification. Another important feature is the comprehensive model for fuel-clad and rod-support interaction. The fuel and clad interact through radial and axial forces.

51621 New aspects of elasto-plastic fracture mechanics analysis - fuel element cladding as an example. Senski, G. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). pp C3/10 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51622 Design for thermal stresses in probabilistic form in clad fuel plates. Smith, C.O. (Nebraska Univ., Omaha (USA). Coll. of Engineering and Technology). pp C2/10 1-14 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

This paper presents equations for the mean values and standard deviations of thermal stresses developed in flat elements. These include clad fuel plates with uniform heat generation in the fuel zone and flat plate claddings with exponential heat generation. Inherent in these equations are the facts that (1) design variables are generally characterized by spectra of values, rather than by unique values, and (2) a small, but finite, probability of failure must be recognized in any design. By coupling the stresses due to the applied loading as calculated by the equations given in the paper with the strength available in a material, reliability (or the alternative probability of failure) can be calculated. Conversely, for a given reliability the appropriate dimensions can be determined. Appropriate illustrations of application of these equations are provided through tables and figures. The difficulty of relying on a factor of safety is demonstrated.

51623 Structual analysis of subassembly wrapper tubes with three-dimensional finite element code KASTEN. Steinbock, L.H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung). pp v.D p.D2/5 1-11 of Structural mechics inreactor technology. Transactions of the 4th international conference held in San Francisco, USA, 15 - 19 Aug 1977. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

A mathematical model of the structural properties of a fuel element under in-pile conditions has to incorporate the wrapper tube, the fuel pins and the spacing devices between them. The finite element method is one way to build such a model because by that it is possible to connect bodies which are as different in shape as the wrapper tube, spacer grids and pins. Despite their different shapes they all may be build out of flat or curved plate elements. The first step in reaching this aim may be the code KASTEN which simulates the mechanical properties of either the wrapper tube or the fuel pin cladding. The code calculates the thermal and neutron swelling strains and the resulting displacements and stresses. The creep strains are calculated iteratively for each time step. External forces induced by pressure, fixed or flexible supports are taken into account and may be changed during the irradiation time. The code has been used to investigate the behavior of pins and wrapper tubes in the planned KNK-II carbide element under various loading conditions and with differential swelling formulas. The result are compared with results of another code and are in good agreement.

51624 Compatible small-scale yielding singular element and its application to LWR fuel rod analysis. Tang, H.T.; Rashid, Y.R. (General Electric Co., San Jose, CA (USA). Nuclear Energy Div.). pp C2/2 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51625 General linear thermoelastic end problem for solid and hollow cylinders. Thompson, J.J.; Chen, P.Y.P. (New South Wales Univ., Kensington (Australia). School of Nuclear Engineering). pp C2/9 1-9 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

This paper reports on three topics arising from work in progress on theoretical and computational aspects of the utilization of self equilibrating and load stress systems, to solve thermoelastic problems of finite, or semi-infinite, solid or hollow circular cylinders, with particular reference to the pellets, rods, tubes and shells with arbitrary internal heat generation encountered in Nuclear Reactor Technology. Specifically the work is aimed at the evaluation of stress intensification factors in the end elastic boundary layer region, due to various thermal and mechanical end load conditions, in relation to the external, exact stress solutions, which satisfy conditions on the curved surfaces only and are valid over the remainder of the cylindrical body. More generally, it is possible, at least for symmetric thermoelastic problems, to derive exact external solutions, using self equilibrating end load systems, which describe the stress/displacement state completely as a combination of a simple local plane strain solution and a correction dependent on the magnitude of axial thermal gradients. Thus plane strain, and self equilibrating end load systems are sufficient for the complete external and boundary layer solution of a finite cylindrical body. This formulation is capable of further extension, e.g. to concentric multi-region problems, and provides a useful approach to the study of local stress intensification factors due to thermal perturbations.

51626 Local strain in cladding tube due to radial pellet cracking. Udoguchi, T.; Asada, Y. (Tokyo Univ. (Japan)); Sato, T. (Design Engineering Division, JGC Corporation, 115 Bessho, Minami-ku, Yokohama, 233, Japan). pp C2/3 1-9 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

A study was made to develop a method for evaluation of the local strain in a cladding tube of the Advanced Thermal Reactor due to radial cracking to a UO_2 fuel pellet. Effects of the number of cracks, initial crack width and the friction coefficient of a pellet-clad interface on behaviors of the local strain in a cladding tube were evaluated with a modelized experiment. Analytical evaluation of a membrane strain was also carried out on the basis of a procedure similar to that proposed by J. H. Gittus, Nuclear Engineering and Design 18 (1972) 69-82, in order to follow the experimental results and to extend the model experiment to cladding tube. A Zircaloy-2 ring specimen with inner diameter of 95 mm, height of 25 mm and wall thickness of 5 mm was expanded at room temperature with equally divided peripheral dice of a tool steel set in a specimen. Strains on an external surface of the specimen were measured with 28 wire strain gages with gage length of 0.3 mm. An elastic-plastic analysis was carried out in order to evaluate the membrane hoop strain in the cladding tube on the basis of a simple procedure similar to that proposed by Gittus. The results of analysis showed that the maximum hoop strain occured at a location apart from the dice edge. This was caused by unloading in the crack opening portion. The strain concentration factor obtained from analysis is greater than that obtained from experiment. The difference of concentration factors between analysis and experiment is due to the bending strain. Therefore, the strain concentration factor at the inner surface is evaluated from the experimental concentration factor at the external surface and the analytical concentration factor of a membrane strain.

51627 Asymmetric fracture of fuel element pellets. Yu, J.C.; Westmann, R.A. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). pp C2/6 1-10 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

This paper presents a linear, elasto-static analysis of a cracked fuel element pellet in a state of plane strain. The problem is reduced to considering an iso-thermal problem where the crack faces are subjected to a normal traction p(r) being given in terms of the known thermal field. The stress and displacement fields are first represented in terms of Bromwich integrals and infinite series. Satisfaction of all of the boundary conditions in the mixed boundary value problem leads to a single set of dual integral equations involving one unknown. An appropriate substitution permits the reduction of these equations to a single Caughy singular equation of the first kind. This equation is then solved and the problem reduced to the numerical solution of a Fredholm integral equation of the second kind. In this way the problem is solved provided the crack length l, pellet radius R, and number of cracks n satisfy the relation (1-l/R)sup(n) $> 10^{-2}$. In the event these conditions occur, the numerical solution breaks down and an alternate formulation must be developed. The solution to this alternate problem is achieved by using a Bromwich integral representation for the stress and displacement fields and using the Wiener-Hopf method. The final results are obtained by numerical evaluation of a Bromwich integral. The solutions to these two problems are checked by considering the special case where p(r) is constant. Good agreement with known solutions is shown to exist verifying the solution scheme and accuracy of the numerical methods.

51628 Regression approach for Zircaloy-2 in-reactor creep constitutive equations. Yung Liu, Y.; Bement, A.L. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). pp C3/3 1-15 of Structural mechanics in reactor technology. Vol. C. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

In this paper the methodology of multiple regressions as applied to Zircaloy-2 in-reactor creep data analysis and construction of constitutive equation are illustrated. While the resulting constitutive equation can be used in creep analysis of in-reactor Zircaloy structural components, the methodology itself is entirely general and can be applied to any creep data analysis. The promising aspects of multiple regression creep data analysis are briefly outlined as follows: (1) When there are more than one variable involved, there is no need to make the assumption that each variable affects the response independently. No separate normalizations are required either and the estimation of parameters is obtained by solving many simultaneous equations. The number of simultaneous equations is equal to the number of data sets. (2) Regression statistics such as R^2- and F-statistics provide measures of the significance of regression creep equation in correlating the overall data. The relative weights of each variable on the response can also be obtained. (3) Special regression techniques such as step-wise, ridge, and robust regressions and residual plots, etc., provide diagnostic tools for model selections. Multiple regression analysis performed on a set of carefully selected Zircaloy-2 in-reactor creep data leads to a model which provides excellent correlations for the data.

CONTROL SYSTEMS

51629 (IAE—2822) **Method for system simplification for studying stability.** Lapin, Yu.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1977. 26p. (In Russian). U 03/MF A01.

A method of system simplification approximation is proposed which is aimed at defining stability regions and obtaining corresponding approximate analytical expressions. The method is tackled in general for an object under control,the linearized equations of which look like equations of an indirect control system. Formulas are derived for evaluating errors of the approximations. The usefulness of the method is exemplified by an automatic reactor start-up system.

51630 (IEA-DT—056) **Calculation of reactivity of control rods in graphite moderated reactors.** Nakata, H. (Instituto de Energia Atomica, Sao Paulo (Brazil); Sao Paulo Univ. (Brazil). Escola Politecnica). May 1978. 64p. (In Portuguese). U 04/MF A01.

A study about the method of calculation for the reactivity of control rods in graphite-moderated critical assemblies, is presented. The result of theoretical calculation, developed by super celles and Nordheim-Scalettar methods are compared with experimental results for the critical Assembly of General Atomic. The two methods are then applicable to reactivity calculation of the control rods of graphite moderated critical assemblies.

51631 (IJS—106/5016-77) **Dynamics and control of nuclear power plants.** Tomsic, M.; Mavko, B.; Aleksic, U.; Stritar, A.; Adrinek, R. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). 1977. 87p. (In Slovenian). U 07/MF A01.

A mathematical model of the power plant with a pressurized water reactor has been prepared and tested. The model is intended for a schematic simulator based on a digital computer. The results of the simulation run for various normal transients are in good agreement with literature data. Equipment for computer control of the experimental reactor TRIGA has been completed. The equipment includes two microcomputers and associated interface circuits. Presently, only data logging is performed. The analyses of random signals on the TRIGA reactor have been continued. Measurements of neutron flux, fuel temperature and cooling water duct have been performed.

51632 (IKE—2-42) **Modular program system for the control of multivariable systems, illustrated by the example of the power treatment system of an in-core thermionic reactor.** Klaiss, H. (Stuttgart Univ. (TH) (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). 8 Aug 1978. 162p. (In German). U 04/MF A01.

For an optimal utilization of the power generated in an incore thermionic reactor, a power processing system must be installed between power generator and consumer. A d.c. transformer with a functional design was chosen for this. For the transformer and for the reactor together with the transformer (overall model), a linear and non-linear mathematical model has been established for a simulation of the dynamic processes. Several control concepts for the plant have been investigated. For a better comparison with conventional methods and with state variable methods, a modular program (MEFARE) has been developed which automates the design of control systems according to the method of state variable feedback on the basis of the system, input, and output matrices of the linearized system. The program checks whether or not a system can be controlled and breaks it up into sub-systems in order to decide whether the desired transformation behaviour is possible. If it is not, it is then extended with the aid of Slivinsky's compensation formalism (SLICOMP program). The new output system is then decoupled again in order to became suitable for the application of the theory of single-variable systems according to Melsa (STVAR program), so that the desired feedback matrices can be calculated.The control concept set up with this program is tested on the models developed by showing that the desired guidance behaviour can be realized. (orig.) 891 RW.

51633 Fluidic self-actuating control assembly. Grantz, A.L. (to Dept. of Energy). US Patent 4,138,320. 6 Feb 1979. Filed date 29 Jun 1978. 8p.

PAT-APPL-920,416.

A fluidic self-actuating control assembly for use in a reactor is described wherein no external control inputs are required to actuate

(scram) the system. The assembly is constructed to scram upon sensing either a sudden depressurization of reactor inlet flow or a sudden increase in core neutron flux. A fluidic control system senses abnormal flow or neutron flux transients and actuates the system, whereupon assembly coolant flow reverses, forcing absorber balls into the reactor core region.

51634 Impact loading of a BWR control rod during braking. Heeschen, U. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). pp D3/8 1-8 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

In an emergency case the control rods of a boiling water reactor are shot into the RPV from below against the weight of the rods with drive motors. According to the position of the control rods between the fuel elements the rods can reach in that case velocities up to 4 m/s. The moved masses of the control rods and of the pistons (both of them are connected by a coupling) are braked through a cup spring which transfers its forces to the RPV-bottom sphere. The spring has to be designed that in this case tthe complete kinetic energy of he control rods of about 1000Nm can be taken up. The spring power and the inertia of the moved masses cause extremely high loadings during and shortly after the impact onto the spring. The shock-like loading propagates along the whole rod at the speed of sound, and this is also the reason why the weaker cross-sections have to endure considerable short-term stress peaks.

ENVIRONMENTAL ASPECTS

51635 (NUREG/CR—0916) **Socioeconomic impacts of nuclear power plants: a paired comparison of operating facilities.** Shields, M.A.; Cowan, J.T.; Bjornstad, D.J. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 188p. (ORNL/NUREG/TM--272). P 09/MF A01.

This study compares the social, economic, and political effects of constructing and operating two nuclear power plants in the rural Southeast: Brunswick 1 and 2 in Brunswick County, North Carolina, and Hatch 1 and 2 in Appling County, Georgia. It is a comparative, post-licensing case study designed to analyze variations in the range and magnitude of impacts experienced by the areas in which the plants were constructed. The study is intended to assist the Nuclear Regulatory Commission in the preparation of socioeconomic impact sections of environmental impact statements for proposed nuclear power stations.

51636 (PNL—2988) **Relationship of human values and energy beliefs to nuclear power attitude.** Rankin, W.L.; Nealey, S.M. (Battelle Human Affairs Research Center, Seattle, WA (USA)). Nov 1978. Contract EW-78-C-06-1076. 96p. P 05/MF A01.

This executive summary highlights the major findings of a nuclear power mail-out survey administered to a random sample of Washington residents, a random sample of nuclear neighbors from the region around the Hanford Reservation, and a random sample of Washington environmentalists. The purpose of the research was twofold. First, it investigated the relationship of human values to one's attitude about the continued development of nuclear power. Second, it investigated the relationship of general energy beliefs and beliefs about specific nuclear power issues to one's attitude about the continued development of nuclear power. The findings are presented in summary form by posing and answering questions of policy relevance to the Department of Energy.

SITING

51637 (IJS—106/2014-76) **Selection of suitable sites for NPP in Slovenia (stage 3).** Grgic, M.; Fabjan, L.; Premru, U. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). 1977. 159p. (In Slovenian). U 09/MF A01.

Selection of suitable sites for nuclear power plants in Slovenia is considered. This includes the studies of available data on regional and local characteristics specified in general site suitability criteria for NPP. The most suitable selected sites will be included into land use urbanistic planning of Slovenia.

RADIOACTIVE EFFLUENTS

REFER ALSO TO CITATION(S) 51423

CHEMICAL AND THERMAL EFFLUENTS

REFER ALSO TO CITATION(S) 52223, 52230

51638 Cooling tower environmental impact prediction in the case of nuclear power plant mixed cooling system. Vehauc, A.; Zaric, Z. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). pp 183-189 of Mechanical engineering energetic. Proceedings of symposium papers. Beograd; Masinski Fakultet Univerziteta u Beogradu (1977). (In Serbian)

From Symposium of mechanical engineering energetic; Beograd, Yugoslavia (1 Dec 1977).

This paper deals with nuclear power plant mixed cooling system and problem of environmental impact predictions. Comparation is made with environmental impact of cooling towers working in recirculation cooling system.

RESEARCH, TEST, AND EXPERIMENTAL REACTORS

REFER ALSO TO CITATION(S) 51509, 51510, 51671, 51672, 51674, 52109, 52318

51639 (FEI—771) **Reactor control by means of mini-computer in real time.** Yazykov, Yu.I.; Andriashin, A.V.; Khassan, M.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1977. 13p. (In Russian). U 02/MF A01.

Described is the system intended for automatic program control and supervision of the nuclear reactor with the aid of a miniature computer, without participation of the operator, in the following modes: development of the desired power in the reactor, operation of the reactor under stationary conditions within a preset time period, transition to another power level, disengagement of the reactor at the end of the preset operating time. 25 starting cycles of the reactor have been performed which prove that the system reliably operates unless the miniature computer and the communication circuits are malfunctioning. Module arrangement of the program portion of the system offers good opportunities for its expansion and check. The system employs only 3% of the miniature computer operating time, so that it is expedient to operate the computer in the multiprogram mode. The memory of the computer includes 16 K, 8 K being allotted for the program and 8 K for the starting history block.

51640 (HEDL-SA—1588) **Initial acceptance test experience with FFTF plant equipment.** Brown, R.K.; Coleman, K.A.; Mahaffey, M.K.; McCargar, C.G.; Young, M.W. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1978. Contract EY-76-C-14-2170. 35p. (CONF-7809110—3). P 03/MF A01.

From Plant experience working group meeting; Ibaraki-Ken, Japan (Sep 1978).

The purpose of this paper is to examine the initial acceptance test experience of certain pieces of auxiliary equipment of the Fast Flux Test Facility (FFTF). The scope focuses on the DHX blowers and drive train, inert gas blowers, H and V containment isolation valves, and the Surveillance and In-service Inspection (SISI) transporter and trolley. For each type of equipment, the discussion includes a summary of the design and system function, installation history, preoperational acceptance testing procedures and results, and unusual events and resolutions.

51641 (HEDL-SA—1679) **FFTF implementation of training requirments for government owned facilities.** Gadeken, A.D.; Izatt, R.D.; Wiborg, J.C. (Hanford Engineering Development Lab., Richland, WA (USA)). 1978. Contract EY-76-C-14-2170. 26p. (CONF-7804149—1). P 03/MF A01.

From 3 symposium on the training of nuclear facility personnel; Gatlinburg, TN, USA (29 Apr 1978).

The Fst Flux Facility (FFTF) is a liquid metal cooled, fast flux reactor plant. It is owned by the Department of Energy (DOE) and is operated by the Hanford Engineering Development Laboratory (HEDL) under a DOE contract with Westinghouse Hanford Company. The FFTF is presently undergoing acceptance testing of sodium systems in preparation for initial criticality in August 1979. It will be used to test fuels and materials, to develop associated components and to gain operating experience for future LMFBR's. The FFTF Training Program is a specific example of how training guidelines provided by NRC can be implemented in principle in a DOE owned reactor. The DOE requirements for government owned facilities and the NRC requirements for commercially owned facilities are compared to components of the FFTF Training program. These components will be described, actual status provided and evaluated as to meeting requirements. Cold Plant Qualification (equivalent to NRC Col Plant Licensing) is the next major milestone for FFTF Operator training. Additional requirements or constraints such as operator time utilization, recruiting and turnover, plant availbility and startup testing greatly affect the ability to meet this milestone. These constraints and requirements and the resulting compromises will be evaluated relative to meeting DOE requirements.

51642 (HEDL-SA—1753-S(Rev.)) **Observations of in-reactor endurance and rupture life for fueled and unfueled FTR cladding.** Lovell, A.J.; Christensen, B.Y.; Chin, B.A. (Hanford Engineering Development Lab., Richland, WA (USA)). 1979. Contract EY-76-C-14-2170. 21p. (CONF-790602—81(Rev.)). 02.

From ANS annual meeting; Atlanta, GA, USA (3 Jun 1979).

Reactor component endurance limits are important to nuclear experimenters and operators. This paper investigates endurance limits of 316 CW fuel pin cladding. The objective of this paper is to compare and analyze two different sets of FTR fuel pin cladding data. The first data set is from unfueled pressurized cladding irradiated in the Experimental Breeder Reactor No. II (EBR-II). This data set was generated in an assembly in which the temperature was monitored and controlled. The second data set contains observations of breached and unbreached EBR-II test fuel pins covering a large range of temperature, power and burnup conditions.

51643 (HEDL-SA—1759-FP) **Effect of a time varying power level in EBR-II on mixed-oxide fuel burnup.** Stone, I.Z.; Jost, J.W.; Baker, R.B. (Hanford Engineering Development Lab., Richland, WA (USA)). 1979. Contract EY-76-C-14-2170. 7p. (CONF-790602—80). P 02/MF A01.

From ANS annual meeting; Atlanta, GA, USA (3 Jun 1979).

A refined prediction of burnup of mixed-oxide fuel in EBR-2 is compared with measured data. The calculation utilizes a time-varying power factor and results in a general improvement to previous calculations.

51644 (HEDL-SA—1838-FP) **CORA: transient analysis code for a cluster of reactor core assemblies.** Johnson, H.G. (Hanford Engineering Development Lab., Richland, WA (USA)). 25 Apr 1979. Contract EY-76-C-14-2170. 29p. (CONF-790602—78). P 03/MF A01.

From ANS annual meeting; Atlanta, GA, USA (3 Jun 1979).

The CORA code is a steady state/transient, core thermal hydraulics code for the FFTF Reactor. A brief overview of the code development and use is presented.

51645 (HEDL-SA—1846) **FFTF materials of construction and surveillance plans.** Shober, F.R. (Hanford Engineering Development Lab., Richland, WA (USA)). 4 May 1979. Contract EY-76-C-14-2170. 35p. Dep. NTIS, PC A03/MF A01.

Portions of document are illegible.

51646 (HEDL-TME—78-89) **Spent thermal reactor fuel assembly characterization with solid state tract recorders.** Gold, R.; Ruddy, F.H.; Lippincott, E.P.; McElroy, W.N.; Roberts, J.H. (Hanford Engineering Development Lab., Richland, WA (USA)). Jun 1979. Contract EY-76-C-14-2170. 35p. P 03/MF A01.

A scoping experiment to characterize the neutron field generated from a Light Water Reactor spent fuel assembly has been successfully completed. Solid State Track Recorder (SSTR) neutron dosimeters were exposed at the surface of a spent fuel assembly from a Pressurized Water Reactor. Acceptable track densities were obtained. From these SSTR neutron dosimetry measurements, an absolute neutron flux of about 8×10^3 n/cm^2 sec was determined at the surface of the spent fuel assembly deduced neutron energy flux, with a mean neutron energy of about 1.3 MeV, is intimately dependent upon the actinide content of the spent fuel.

51647 (HEDL-TME—79-4) **Irradiation effects in FFTF radial reflector materials.** Ward, A.L.; Blackburn, L.D. (Hanford Engineering Development Lab., Richland, WA (USA)). Feb 1979. Contract EY-76-C-14-2170. 44p. AT.

Postirradiation tension tests and swelling measurements were performed on actual FFTF radial reflector materials (316 SS and Alloy 600) irradiated in EBR-II to a total fluence of 2.7×10^{22} n/cm^2 at temperatures of 514, 566, and 691°C. Ductility results for 316 SS indicate that the portion of reflector lifetime associated with reaching a uniform elongation level of 10% was estimated conservatively by a factor of 2 to 3 in the design. Swelling results at this relatively low fluence were generally consistent with correlations used for reflector design. Data from higher exposure irradiation tests are needed for final verification of reflector design lifetime predictions.

51648 (HEDL-TME—79-30) **Pipelines supported by nonlinear load-resisting mechanical snubbers.** Barta, D.A. (Hanford Engineering Development Lab., Richland, WA (USA)). Jul 1979. Contract EY-76-C-14-2170. 48p. AT.

An analytical study of effects of nonlinearities in piping supports on response to seismic excitation is presented. Response calculations for simplified single degree of freedom nonlinear models are used to illustrate sensitivity to stiffness variations, lost motion, and impact damping. Seismic responses of typical spans of various sizes of piping supported by both linear and nonlinear constraints are compared to assess the support load magnifications due to impacting. The idealized nonlinear piping support models are integrated with a finite element model of a large piping system. Time domain seismic responses of the nonlinear piping system are compared to loads determined by a standard linearized seismic response spectra technique.

51649 (LTR—141-103) **Results of tests to evaluate the use of an in-core liquid level transducer (LLT) to measure void fraction.** Hoskinson, R.L.; Helbert, H.J. (Idaho National Engineering Lab., Idaho Falls (USA)). 18 May 1979. Contract EY-76-C-07-1570. 51p. P 04/MF A01.

The results are presented of tests conducted at the LOFT Test Support Facility (LTSF) using a Liquid Level Transducer (LLT) to measure void fraction. The LLT used was an in-core transducer S/N 445. The purpose of these tests was to evaluate the LLT as a void fraction measuring instrument. Tests were conducted at atmospheric pressure and room temperature by partially filling a test column with demineralized water and bubbling oxygen from the bottom. The liquid level was measured with a metric rule on the side of the test column before any gas injection.

51650 (NUREG/CP—0006, pp I.2.1-I.2.45) **Development of two-phase mass flow measurements at INEL.** Fincke, J.R. May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

This paper will briefly describe the development of instrumentation and techniques for the measurement of mass flow rate in two-phase flows performed at the Idaho National Engineering Laboratory (INEL) during the past year. The instrumentation to be described is a drag-disc turbine transducer (DTT) which is intended to provide mass flow rate information when used either alone or with a gamma densitometer, the use of Pitot tubes in combination with a gamma densitometer, and the use of full-flow drag devices (screens) also used in combination with a gamma densitometer.

51651 (NUREG/CP—0006, pp I.3.1-I.3.28) **PBF radiation hardened gamma densitometer.** Taylor, D.J.; Porter, E.H.; Orvis, W.J. May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

Data from the LOCA-11 test series have shown that a gamma densitometer based on a beam modulation and phase sensitive detection will work extremely well during a blowdown in a nuclear environment. Densities measured by the densitometer are in agreement with the RELAP code predictions mode before the test.

51652 (ORNL—5181) **Analysis of the ZPR-9 reverse approach to critical (RAC) low level flux monitor experiment.** Selby, D.L.; Flanagan, G.F.; Fox, P.B.; Simpson, D.B. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 37p. AT.

An experiment was performed in the ZPR-9 facility at Argonne National Laboratory to determine the adequacy of the ex-core Low Level Flux Monitors (LLFMs) for monitoring the initial approach to critical in the Fast Flux Test Facility (FFTF). While the purpose of the LLFMs (which are located in the radial shield) is to monitor refueling operations, if they prove to be adequate for monitoring the initial loading operation they would be more convenient and less expensive than in-core detectors. From the analysis performed it was determined that the detectors were located so close to the core that spatial effects in the core became a dominant factor. The detector response was influenced more by localized events than by events occurring over the core as a whole. This made interpretation very difficult, if not impossible.

51653 **Thermomechanical behaviour of fuel particles in a matrix during reactor power excursions.** Brittan, R.O.; Smith, R.S. (Argonne National Lab., IL (USA)). pp D3/4 1-10 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

Transient Test Reactors may use fuel material consisting of dispersions of fuel particles in matrix material. This work determines the largest particle size that can be used in fabricating fuel material without exceeding temperature or stress criteria during transient operation. To do this temperature distribution histories must be determined for various particle sizes and volume fractions using typical power density histories of transient reactor operation. From these, the critical stresses are calculated. The model chosen to accomplish this is a spherical fuel particle in a spherical matrix shell. A computer code was prepared to solve the model performance, yielding the temperature and stress distribution histories. Material property variation with temperature is employed, along with a close mockup of the power density history during self-limiting reactor transients. To date, four fuel systems have been investigated: 1) UC - ZrC particles in graphite; 2) UO_2 particles in graphite; 3) UO_2 particles in chromium 4) UO_2 particles in stainless steel. The study indicates that the maximum allowable particle diameter varies as the square root of the initial transient period and on the particle volume fraction.

51654 Parametric analysis of fuel can designs for a safety test facility. Chopra, P.S.; Mamoun, M.M.; Wu, T.S.; Rardin, D.C. (Argonne National Lab., IL (USA)). pp D4/5 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

PLUTONIUM AND ISOTOPE PRODUCTION REACTORS

REFER ALSO TO CITATION(S) 51501, 51502

51655 (UNI—1270-W/DEL) **Grafoil applications on-plant.** Pociluyko, M. (United Nuclear Industries, Inc., Richland, WA (USA)). 1 Mar 1979. Contract EY-76-C-06-1857. 31p. P 03/MF A01.

Portions of document are illegible.

Presented in this report are the quantitative and qualitative aspects of the more than 5,800 applications of Grafoil on-plant. The subject all-graphite product was originally made by the Union Carbide Corporation. Its utilization in the forms of valve packing, gasketing and sealant tapes for leak repair and prevention on-plant since March 1970 is marked with typical zero-leak results. For all practical purposes, the successful results with Grafoil implementation indicate an unqualified control of leakage problems that began in 1967 with the V-11 and V-12 valves in the primary system of N Reactor. Meaningfully, the accruals of savings with existing and future applications shall continue to be incalculable in personnel exposure, maintenance, and capital. Inherent in the savings are the devised methodology and innovative developments coordinately employed in resolving the leak repair problems.

PROPULSION REACTORS

51656 (LA—7711-MS) **NEPS reactor and heat exchanger. Summary status (December 1978).** Koenig, D.R. (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 21p. P 02/MF A01.

The design of a 3 MW(+) heat-pipe cooled nuclear reactor for electric propulsion of spacecrafts has been evolving continually. Several modifications have been made to make the reactor design more tolerant of potential heat pipe failures. Design parameters and operating characteristics for the modified reactor are presented. The desirability of separating the reactor assembly from the thermionic converter assembly has been recognized, and an intermediate heat exchanger to couple the two subassemblies together has been conceptualized.

REACTOR SAFETY

REFER ALSO TO CITATION(S) 51162, 51789, 52111

51657 (ANL—78-15) **Chemical Engineering Division reactor fuels and materials chemistry research: July 1976—September 1977.** (Argonne National Lab., IL (USA)). Jul 1978. Contract W-31-109-ENG-38. 111p. AT.

Reactor safety studies were directed primarily toward obtaining high-temperature physical property data for use in reactor safety analyses. Spectroscopic data and an oxygen-potential model were used to calculate thermodynamic properties applicable to the equations of state of $(U,Pu)O_2$ and UO_2. Work was continued on the compilation of standard sets of property data on reactor fuels and materials. The viscosity of molten alumina and the thermal diffusivity of molten UO_2 were measured as functions of temperature. Modeling and chemical-interaction studies related to post-accident heat removal were conducted. The efforts in sodium technology supported the LMFBR program. Studies were conducted to explore the feasibility of upgrading the quality of commercial-grade sodium and sodium from decommissioned reactors to provide new sources of reactor-grade sodium. Work was started on the development of methods for disposal of contaminated alkali—metal wastes. In work related to tritium, a model was developed to describe the behavior of tritium in an LMFBR, tritium permeation through steam-generator materials was measured, and an in-sodium tritium meter was developed and tested in reactor environments. Work in the area of fuels and materials chemistry was conducted in support of the GCFR program. Portions of the cesium—uranium—oxygen phase diagram were investigated to aid in understanding the reaction of fission-product cesium with urania blanket material, particularly in relation to axial gas flow in vented GCFR fuel pins. Data on the oxidation of vanadium, niobium, and titanium were assessed to determine the suitability of these materials for use in controlling oxidative attack of stainless steel cladding.

51658 (ANL-CT—79-36) **Mixing in a pool-type PLBR after a scram.** Howard, P.A.; Haried, J.A. (Argonne National Lab., IL (USA)). Jun 1979. Contract W-31-109-ENG-38. 116p. AT.

Transient flow patterns were simulated for eleven geometric variations of a pool-type PLBR. The effects of coolant density changes due to a reactor scram were simulated using water in a 1/15-scale model of the hot and cold pools. The influence of Intermediate Heat Exchanger (IHX) inlet height, gap beneath the Upper Internal Structure (UIS), and UIS exit height on coolant flow were studied in the hot pool. Transients with and without pump trips were included in this study. Dye injection allowed visual observation of the flow patterns within the hot pool. The results for the hot pool were compared to an existing computer model, Plenum-2A. In addition, the cold pool was analyzed during simulated upshock transients with various primary pump inlet heights.

51659 (CAAP-TR—047) **Preliminary application of quantitative assessment procedure. Interim report.** Dearien, J.A.; Davis, C.B. (Idaho National Engineering Lab., Idaho Falls (USA)). Apr 1979. Contract EY-76-C-07-1570. 111p. P 06/MF A01.

A procedure has been developed to quantify the results of code assessment and relate this quantified result to the percentage of knowledgeable analysts who would be expected to find the code acceptable. The quantification procedure was applied to two Semiscale tests and the results of the assessment process indicate that 50% to 70% of knowledgeable analysts would find the code results an acceptable representation of the experimental data. The results are preliminary due to the limited amount of data at present but are very encouraging with respect to future application of the procedure.

51660 (CONF-790745—1) **Two-phase flow measurements with advanced instrumented spool pieces and local conductivity probes.** Turnage, K.G.; Davis, C.E. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 33p. P 03/MF A01.

From Reactor Safety Instrumentation Review Group meeting; Silver Spring, MD, USA (24 Jul 1979).

A series of two-phase, air-water and steam-water tests performed with instrumented spool pieces and with conductivity probes obtained from Atomic Energy of Canada, Ltd. is described. The behavior of the three-beam densitometer, turbine meter, and drag flowmeter is discussed in terms of two-phase models. Application of some two-phase mass flow models to the recorded spool piece data is made and preliminary results are shown. Velocity and void fraction information derived from the conductivity probes is presented and compared to velocities and void fractions obtained using the spool piece instrumentation.

51661 (COO—4261-11) **Simulation of heat and mass transfer processes in molten core debris-concrete systems.** Felde, D.K. (Wisconsin Univ., Madison (USA)). 1979. Contract EN-77-S-02-4261. 116p. P 06/MF A01.

Thesis.

The heat and mass transport phenomena taking place in volumetrically-heated fluids have become of interest in recent years due to their significance in assessments of fast reactor safety and post-accident heat removal (PAHR). Following a hypothetical core disruptive accident (HCDA), the core and reactor internals may melt down. The core debis melting through the reactor vessel and guard vessel may eventually contact the concrete of the reactor cell floor. The interaction of the core debris with the concrete as well as the melting of the debris pool into the concrete will significantly affect efforts to prevent breaching of the containment and the resultant release of radioactive effluents to the environment.

51662 (COO—4261-12) **Growth of molten core debris pools in concrete. Progress report, April 1—June 30, 1979.** Abdel-Khalik, S.I. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). 1 Jul 1979. Contract EN-77-S-02-4261. 48p. P 03/MF A01.

The heat and mass transfer processes taking place in molten core debris/concrete systems have been experimentally investigated. Two types of experiments have been conducted. The first experiment simulates the growth of a molten debris pool in a composite sacrificial bed. This experiment models debris pool growth in an inner, low-melting point, sacrificial material zone followed by a melting attack on the concrete bed. The purpose of the inner zone is to quickly melt and dilute the debris pool so that its subsequent downward growth in the concrete may be slowed. In the second experiment a two-layer immiscible liquid system is volumetrically heated and allowed to melt into a low-density gas-releasing solid bed which is miscible in the initially-higher-density bottom liquid. The solid melts, mixes with, and dilutes the bottom liquid pool until its density is lower than that of the top liquid. At this time pool inversion occurs and the immiscible liquid sinks to the bottom of the pool displacing the now lighter fuel-concrete simulant.

51663 (EUR—5787) **Dynamic material properties of several steels for fast breeder reactor safety analysis. Final report.** Albertini, C.; Montagnani, M. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1977. 52p. U 04/MF A01.

Hypothetical explosion accidents which could occur in fast breeder reactors require reactor structures designed taking into account the material constitutive equations under dynamic loading. In order to determine such an equation which relates the flow stress to the applied strain and strain-rate, we have developed the following two devices to perform uniaxial tensile tests at a constant strain-rate: a hydro-pneumatic machine which permits tests at strain-rates ranging between 10^{-1} and 10^{2} sec^{-1}; a modified Hopkinson bar with a prestressed bar loading device which permits tests at strain-rates ranging between 10^{2} and 10^{3} sec^{-1}. The tests can also be performed at high temperatures, up to 1000°C. By means of an image converter fast camera it is possible to obtain true stress/strain/strain-rate diagrams. In the frame of the collaboration contract 106-73 PIPGD/G.F.K./330/A3/275912 with G.F.K. Karlsruhe we have investigated the strain rate effects on the mechanical properties of several austenitic and carbon steels (DIN X8 CRNIMONB 1616, DIN X2 CRNI 189, DIN ST 35) using the equipment briefly described above. Generally speaking all the three materials showed a marked srain-rate sensitivity; for example from the curves of the austenitic steel DIN X2 CRNI 189 we have noted that at room temperature with increasing strain-rate the flow stress at a given strain normally increases, wherever elongation to rupture is reduced.

51664 (GA-A—15313) **GCFR Safety Program in the US overview and status.** Torri, A.; Kelley, A.P.; Emon, E.E. (General Atomic Co., San Diego, CA (USA)). May 1979. Contract EY-76-C-03-0167-023. 21p. (CONF-790384—1). P 02/MF A01.

From GCFR safety specialist meeting (NEA/IAEA); Brussels, Belgium (13 Mar 1979).

The GCFR Safety Program in the US has evolved over the past 10 years. Since 1968 utilities have supported the analysis of operational safety characteristics within the design basis envelope. Since 1974 DOE has supported probabilistic safety technology work and an assessment of postulated events beyond the design bases. In 1978 a first issue of a GCFR Safety Program Plan was completed with the dual objectives of assuring that the DOE sponsored program addresses all important safety considerations related to public safety with the appropriate priority, and of serving as a tool for the integration of the GCFR safety programs carried out at General Atomic, Argonne National Laboratory, Los Alamos Scientific Laboratory and at EG & G Idaho. The plan defines 5 task areas - Definition Studies, Probabilistic Technology, Core Accident Technology, Primary Vessel Containment Technology and Secondary Containment Technology. For each task specific objectives are defined and a set of task elements are identified through which the task objectives will be accomplished.

51665 (GA-A—15461) **Core meltdown assessment in the GCFR.** Torri, A.; Frank, M.; Kang, C. (General Atomic Co., San Diego, CA (USA)). May 1979. Contract EY-76-C-03-0167-023. 21p. P 02/MF A01.

This paper discusses the chronological sequence of events and supporting analysis during a total loss of all coolant circulation in the GCFR with top supported core. Redundant and diverse cooling systems provided for decay heat removal reduce the probability of this postulated event below the range of plant design bases. It is nevertheless considered to investigate the potential for consequence mitigation and containment margin. Two distinct phases of the sequence are discussed: 1) the core response to a total loss of coolant circulation and 2) the capability of the PCRV to retain molten fuel debris. GCFR specific design features to prevent recriticality and fuel vaporization due to fuel slumping are under investigation. Analytical and experimental work is in progress to evaluate the feasibility of such early accident termination mechanisms. Several concepts for post accident fuel containment have been identified and appear technically feasible.

51666 (GA-A—15463) **Role of probabilistic analysis in the GCFR Safety Program.** Kelley, A.P.; Torri, A.; Emon, D.E. (General Atomic Co., San Diego, CA (USA)). May 1979. Contract EY-76-C-03-0167-023. 16p. (CONF-790384—2). P 02/MF A01.

From GCFR safety specialist meeting (NEA/IAEA); Brussels, Belgium (13 Mar 1979).

Since early 1974, a program of probabilistic safety studies of the GCFR has been underway in the US, principally under Department of Energy sponsorship. Results from this program to date have been reported in five major topical reports and several conference papers. The program during this period has evolved into four principal activities which form a hierarchy of work flow in that the results from one activity provide the basis for establishing the area of emphasis in succeeding activities. This paper summarizes the approach and major conclusions which have been reached in each of the four probabilistic safety study areas. In addition, the paper identifies how the conclusions of this work have affected safety research activities and the design of the GCFR, as well as how the work is expected to be factored into the US GCFR engineering effort in the future.

51667 (GEAP-NUREG—23977) **BWR blowdown/emergency core cooling program: 64-rod bundle blowdown heat transfer (8 x 8 BDHT). Final report.** Hwang, W.S.; Schneidman, B.S. (eds.). (General Electric Co., San Jose, CA (USA). Nuclear Energy Engineering Div.). Sep 1978. 184p. C .

System performance and thermal response characteristics of BWR's, during the blowdown phase of the postulated loss-of-coolant accident (LOCA) conditions, were investigated in a test apparatus with different scaled configurations. Effects of the configuration changes on the system responses were identified. Test data obtained serve as baseline data for the BD/ECC interaction experiments and information to tie back to the previous 7 x 7 BDHT tests. Comparisons of the predictions with the tests were made.

51668 (GEFR—00419) **Preliminary models for evaluating radiological source terms.** Huang, T.C.; Dayan, A.; McDonald, J.W.; Teresi, J.D. (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). 17 Nov 1978. Contract EY-76-C-03-0893-032. 48p. AT.

The purpose of the safety work described herein is to develop thechnology for evaluating mechanisms that attenuate radiological consequences. This report presents model developments from October 1977 through September 1978 (FY 1978) and indicates experimental needs regarding model development and verification. The work covers modeling of extremely low-probability accident scenarios resulting in fuel vaporization and discharge of sodium and core debris to the containment building, the generation of melt-through source terms by sparging and vaporization, and the attenuation of energetics and melt-through source terms.

51669 (GEFR-SP—027) **Risk allocation approach to reactor safety design and evaluation.** Gokcek, O.; Temme, M.I.; Derby, S.L. (General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.). 23 Aug 1977. Contract EY-76-C-03-0893-019. 7p. (CONF-780507—20). P 02/MF A01.

From Probabilistic analysis of nuclear reactor safety; Los Angeles, CA, USA (8 May 1978).

The techniques of probabilistic risk assessment and risk allocation are viable and valuable tools for establishing safety reliability goals for nuclear power plants. These methods allow quantitative design goals to be derived from a risk acceptance constraint. The basic concept described in this paper can be applied to other type power generating plants with minor modifications.

51670 (GRS-F—63) **Report on the research projects in the field of reactor safety sponsored by the Federal Minister for Research and Technology. Period under report: January 1 - March 31, 1978.** (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Sep 1978. 520p. (In German). U 23/MF A01.

Investigations on the safety of Light Water Reactors (LWR) being performed in the framework of the Research Program Reactor Safety (RS - Projects) are sponsored by the BMFT (Federal Minister for Research and Technology), Bundesminister fuer Forschung und Technologie. Objective of this program is to investigate in greater detail the safety margins of nuclear power plants and their systems and the further development of safety technology. Besides the investigations of LWR tasks first projects on the safety of FBR type reactors are sponsored by the BMFT. The GRS (Reactor Safety Association), Gesellschaft fuer Reaktorsicherheit mbH, by order of the BMFT, informs continuously of the status of such investigations by means of quarterly and annually publication of progress reports within the series GRS - F -Fortschrittsberichte (GRS - F - Progress Reports). Each progress report represents a compilation of individual reports about objectives, the work performed, the results, the next steps of the work etc. The individual reports are prepared in a standard form by the contractors themselves as a documentation of their progress in work, The individual reports are arranged according to the amended LWR Safety Research Program of the BMFT. Another table contents uses the same classification system as applied in the Nuclear Safety Index of the CEC Communities and the OECD. (orig./HP) 891 HP.

51671 (HEDL-SA—1640) **Load rating and design criteria for pipe snubbers with extension struts.** Entz, R.D.; Anderson, M.J. (Hanford Engineering Development Lab., Richland, WA (USA)). Feb 1979. Contract EY-76-C-14-2170. 7p. (CONF-790615—25). P 02/MF A01.

From 3. US national congress on pressure vessels and piping; San Francisco, CA, USA (25 Jun 1979).

Snubbing devices are used extensively in nuclear power plant piping to prevent seismic shock forces from causing damaging pipe motions. Most seismic snubbers are designed and load rated by the manufacturer without consideration of attaching structure, unless specifically requested to do so by the purchaser. This paper discusses the additional design constraints imposed by the use of extension struts with the seismic snubbers. The constraints evaluated include

load rating reduction as a function of strut length, and strut length limitations to pevent dynamic instability.

51672 (HEDL-SA—1669) **Summary of HEDL sodium fire tests.** Hillard, R.K. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1978. Contract EY-76-C-14-2170. 69p. (CONF-7811137—1). P 04/MF A01.

From IAEA/IWGFR specialists meeting; Cadarache, France (20 Nov 1978).

The sodium fire test program and related studies at the Hanford Engineering Development Laboratory (HEDL) are described. The program is analytical and experimental in scope, with computer code development and experimental verification. Tests have ranged in size from gram quantity laboratory tests to 1600-kg sodium spills. The experimental work is performed in two facilities: the Large Sodium Fire Facility (LSFF) and the Containment Systems Test Facility (CSTF). Sodium fire extinguishment tests which verified the Fast Flux Test Facility (FFTF) secondary sodium fire protection system are described and related informaion on sodium burning rates and smoke release rates are correlated. The burning rates are compared to theoretical predictions based on heat and mass transfer analogy, with good agreement. Comparisons with the SOFIRE-II code are also made. Sodium combustion aerosol properties are defined as to chemical and physical nature, settling in closed vessels and effect of added water vapor. The HAA-3B aerosol behavior computer code is compared to tests in the 850-m^3 CSTF containment vessel. Sodium spray tests in the CSTF are compared with the SPRAY computer code. An air cleaning program is described, which has the objective of removing high mass concentration sodium combustion aerosols from vented cells and containment buildings. The aerosol mass holding capacity of commercial filters was measured and an aqueous scrubber system is described. The effects of sodium spills on cell structures were investigated, including water release from heated concrete, the reaction of sodium with concrete, the formation and spontaneous recombination of hydrogen, and the ability of steel cell liners to withstand large spills of high temperature sodium without leaking.

51673 (HEDL-SA—1755-FP) **Comparison of in-reactor and out-of-reactor fuel pin cladding strain under transient loading.** Duncan, D.R.; Hunter, C.W.; Thielges, J.R.; Hikido, T.; Hanson, J.E. (Hanford Engineering Development Lab., Richland, WA (USA)). 1979. Contract EY-76-C-14-2170. 9p. (CONF-790602—76). P 02/MF A01.

From ANS annual meeting; Atlanta, GA, USA (3 Jun 1979).

Results of two recent fuel pin transient tests performed in Mark II-C sodium loops in the TREAT reactor are compared with out-of-reactor transient test results. The TREAT pins were irradiated in EBR-II in the WSA-3 experiment; steady-state irradiation and TREAT test parameters are presented. Out-of-reactor transient tests in the Fuel Cladding Transient Tester (FCTT) measured the deformation and failure behavior of unirradiated specimens and irradiated fuel pin cladding specimens under constant internal gas pressure loading and transient temperature conditions. All fuel pins were 20% cold-worked AISI 316 stainless steel.

51674 (HEDL-SA—1769) **Analysis of piping systems with nonlinear supports subjected to seismic loading.** Barta, D.A. (Hanford Engineering Development Lab., Richland, WA (USA)). Mar 1979. Contract EY-76-C-14-2170. 23p. (CONF-790615—18). P 02/MF A01.

From 3. US national congress on pressure vessels and piping; San Francisco, CA, USA (25 Jun 1979).

An analytical study of effects of nonlinearities in piping supports on response to seismic excitation is presented. Response calculations for simplified single degree of freedom nonlinear models are used to illustrate sensitivity to stiffness variations, lost motion and impact damping. Seismic responses of typical spans of various sizes of piping supported by both linear and nonlinear constraints are compared to assess the support load magnifications due to impacting. The idealized nonlinear piping support models are integrated with a finite element model of a large piping system. Time domain seismic responses of the nonlinear piping system are compared to loads determined by a standard linearized seismic response spectra technique.

51675 (HEDL-TME—79-22) **Users' guide to CACECO containment analysis code.** Peak, R.D. (Hanford Engineering Development Lab., Richland, WA (USA)). Jun 1979. Contract EY-76-C-14-2170. 216p. P 10/MF A01.

The CACECO containment analysis code was developed to predict the thermodynamic responses of LMFBR containment facilities to a variety of accidents. The code is included in the National Energy Software Center Library at Argonne National Laboratory as Program No. 762. This users' guide describes the CACECO code and its data input requirements. The code description covers the many mathematical models used and the approximations used in their solution. The descriptions are detailed to the extent that the user can modify the code to suit his unique needs, and, indeed, the reader is urged to consider code modification acceptable.

51676 (HEDL-TME—79-28) **Aerosol behavior during sodium pool fires in a large vessel: CSTF tests AB1 and AB2.** Hilliard, R.K.; McCormack, J.D.; Postma, A.K. (Hanford Engineering Development Lab., Richland, WA (USA)). Jun 1979. Contract EY-76-C-14-2170. 160p. P 08/MF A01.

Two large-scale aerosol behavior tests, using sodium pool fires as the aerosol source, were performed in the Containment Systems Test Facility (CSTF). The tests were conducted to characterize the properties and behavior of sodium aerosol particles formed and aged in a large containment vessel. The 20-m high, 850-m^3 CSTF containment building in regard to parameters that affect agglomeration and gravitational settling. In both tests, sodium burned for one hour in a 4.38-m^2 pool, and the only difference between them was that steam was injected during the second test, simulating the release of water vapor from heated concrete.

51677 **Response of subassembly model with internals.** Kennedy, J.M. (Argonne National Lab., IL (USA)); Belytschko, T. (Illinois Univ., Chicago (USA)). pp E3/1 1-14 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

In safety analysis at the subassembly level, the following aspects of subassembly response are of concern: (1) the structural integrity of the subassembly within which the accident occurs: (2) the structural integrity of adjacent subassemblies, particularly the maintenance of sufficient cross sectional area for flow of the coolant: and (3) prevention of damage to fuel pins in the adjacent subassembly, for this could lead to additional energy release and thus the propagation of the accident. For the purpose of predicting the structural response in such accident environments, a program STRAW has been developed. This is a finite element program which can treat the structure-fluid system consisting of the coolant and the subassembly walls. Both material nonlinearities due to elastic-plastic response and geometric nonlinearities due to large displacements can be treated. The energy source can be represented either by a pressure-time history or an equation of state.

51678 (IDO—1570-T13) **WRRD monthly report for May 1979.** (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1979. Contract EY-76-C-07-1570. 130p. P 07/MF A01.

Cost data and brief technical summaries are presented for the LWR research activities: semiscale program, thermal fuels behavior program, 3-D program, code development and analysis, code assessment and applications, and construction for GPP and line items.

51679 (IEA-DT—058) **Determination of the safety zones of Angra dos Reis Nuclear Power Plant, according to the model of radion diffusion in the atmosphere.** Santina, M.D. (Instituto de Energia Atomica, Sao Paulo (Brazil); Sao Paulo Univ. (Brazil). Escola Politecnica). Jun 1978. 161p. (In Portuguese). U 08/MF A01.

The safety distance for Angra dos Reis Nuclear Power Plant are calculated, based on the model of the maximum credible accident for PWR power reactors and on the calculation of the dose due to hypothetical accidental release of radioactivity, using the model of radiation dispersion in the atmosphere. The safety distances for the Angra dos Reis reactors are also calculated using the model of the nine accident categories of the Rasmussen Report. The values of probability associated to each type of accident are used with the respective fractions of radiation release to the atmosphere. The soil contamination is also calculated for all the accidents considered and for several conditions of atmospheric stability, according to the model developed by Chamberlain. The program ACRA-II is used for calculation of the diffusion of radiation in the atmosphere, and the doses associated to it.

51680 (JAERI-M—7594) **LWR containment spray iodine removal calculation code. MIRA-PB.** Nishio, G.; Tanaka, M.; Tamura, T. (Japan Atomic Energy Research Inst., Tokyo). Mar 1978. 113p. (In Japanese). U 06/MF A01.

In the reactor containment vessel of LWR, there are containment sprays and air-cleaning filters to prevent the release of radioiodine from the reactor building to the atmosphere in LOCA. The computer code MIRA-PB for predicting iodine removal by containment spray is made on the basis of MIRAP/MIRAB code developed in Battelle's Columbus Laboratories. MIRA-PB considers behavior of elemental iodine, organic iodide, and iodic aerosol in natural deposition, liquid-film absorption, spray washout, filteration, and leakage to atmosphere. Information is obtained on the contributions of sprays to iodine removal under LOCA conditions which depends on partition coefficient of elemental iodine and organic iodide, pH, temperature, concentrations in gaseous and liquid phases, physical properties of spray, motion of spray droplets in the containment vessel, and mass-transfer rate from gaseous to liquid phase. Iodine removal by sprays in PWR, BWR, Battelle's CSE and JAERI-model containment is calculated by MIRA-PB under LOCA simulated condition.

51681 (JAERI-M—7712) **Prediction of ROSA-III experiment. RUN 701.** Soda, K. (Japan Atomic Energy Research Inst., Tokyo). Jun 1978. 97p. U 06/MF A01.

ROSA-III experiment with the simulated BWR system is to investigate thermal hydraulic behavior as well as ECCS performance in a postulated loss-of-coolant accident. RUN 701 assumes average core power, high and low pressure core sprays and low pressure injection of ECCS. Prediction of experiment RUN 701 was made with computer code RELAP-4J. The results indicate the need for ROSA-III pump characteristics to be clarified and for liquid level formation model to be improved. Comparison of the prediction results with the experimental data should reveal the areas of modifications in calculation model.

51682 (KFK—2656) **Theoretical investigations of the gas flow in ballooning LWR-fuel rods.** Gaballah, I. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Sep 1978. 15p. (In German). U 03/MF A01.

A theory is developed for the calculation of gas flow in a fuel rod simulator or in a fuel rod with round- or cracked pellets. The fundamental equations are formulated, simplified, reformed, and then numerically solved. The numerical investigations show, that a quasi steady incompressible flow model can be used without great error. The effect of the deformation form is studied. A uniform deformation along the whole length causes small pressure difference. A power profile and rod spacers cause non-uniform clad deformation of the fuel rod simulator or the fuel rod. This deformation leads to greater pressure differences. Finally the effect of the cracked pellets is studied. The cracked pellets cause great pressure differences along the fuel rod. (orig.) 891 HP.

51683 (KFK—2657) **Contribution to a theory of two-phase flow with phase change and addition of heat in a coolant channel of a LWR-fuel element during a loss-of-coolant accident.** Gaballah, I. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Sep 1978. 64p. (In German). U 04/MF A01.

A contribution to a theory of two-phase flow with phase change and addition of heat in a coolant channel of a LWR-fuel element during a loss-of-coolant accident. A theory was developed for the calculation of a dispersed two phase flow with heat addition in a channel with general area change. The theory was used to study different thermodynamic and gasdynamic processes, which may occur during the emergency cooling after a LOCA of a pressurized water reactor. The basic equations were formulated and solved numerically. The heat transfer mechanism was examined. Calculations have indicated that the radiative heat flux component is small compared to the convective component. A drop size spectrum was used in the calculations. Its effect on the heat transfer was investigated. It was found that the calculation with a mean drop diameter gives good results. Significant thermal non-equilibrium has been evaluated. The effect of different operating parameters on the degree of thermal non-equilibrium was studied. The flow and heat transfer in a channel with cross-sectional area change were calculated. It was shown that the channel deformation affects the state properties and the heat transfer along the channel very strongly. (orig.) 891 GL.

51684 (LA-UR—79-1874) **Overview and status of the SIMMER testing program.** Scott, J.H. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 13p. (CONF-790816—16). P 02/MF A01.

From International meeting on fast reactor safety technology; Seattle, WA, USA (19 Aug 1979).

Los Alamos Scientific Laboratory has undertaken an extensive experiment analysis program to test the results of SIMMER Liquid Metal Fast Breeder Reactor (LMFBR) accident calculations. Initially, we will test the postdisassembly work-energy partition problem. The SIMMER-calculated order-of-magnitude reduction of available kinetic energy following a severe hypothetical core-disruptive accident (HCDA) can be attributed to (1) purely fluid-dynamic effects; and (2) rate-controlled effects, such as phase transitions and heat transfer. We have chosen to test separately each class of mitigator. In this paper we review the experiments initially chosen for testing of each class of mitigator and report on the status of the analyses. We enumerate several problems in SIMMER that experiment analysis has disclosed. Finally, needs for future experiments are discussed.

51685 (LBL—7984) **Sloshing of water in torus pressure-suppression pool of boiling water reactors under earthquake ground motions.** Aslam, M.; Godden, W.G.; Scalise, D.T. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1978. Contract W-7405-ENG-48. 123p. P 06/MF A01.

This report presents an analytical and experimental investigation into the sloshing of water in torus tanks under horizontal earthquake ground motions. This study was motivated because of the use of torus tanks for pressure-suppression pools in Boiling Water Reactors. Such a pressure-suppression pool would typically have 80 ft and 140 ft inside and outside diameters, a 30 ft diameter section, and a water depth of 15 ft. A general finite element analysis was developed for all axisymmetric tanks and a computer program was written to obtain time-history plots of sloshing displacements of water and dynamic pressures. Tests were carried out on a 1/60th scale model under sinusoidal as well as simulated earthquake ground motions. Tests and analytical results regarding natural frequencies, surface water displacements, and dynamic pressures were compared and a good agreement was found within the range of displacements studied. The computer program gave satisfactory results within a maximum range of sloshing displacements in the full-size prototype of 30 in. which is greater than the value obtained under the full intensity of the El Centro earthquake (N-S component 1940). The range of linear behavior was studied experimentally by subjecting the torus model to increasing intensities of the El Centro earthquake.

51686 (LTR—111-126) **Summary of reactor plant conditions during L2-2 pre-LOCE maneuver.** Tsang, F.Y.; Yarbrough, W.M.; Cannon, J.W.; Kuffner, J.A. (Idaho National Engineering Lab., Idaho Falls (USA)). 26 Apr 1979. Contract EY-76-C-07-1570. 156p. (RE-P—79-021). P 08/MF A01.

This document presents the experimental results obtained during the pre-Loss of Coolant Experiment (LOCE) manuever and the core conditions prior to the L2-2 LOCE. The peak linear heat rate prior to the blowdown was 8.04 kW/ft, the primary coolant mass flow rate was 1.539 Mlbm/hr, the hot leg temperature was 585.9°F, and the core ΔT was 42°F. These conditions satisfied the requirements specified for the L2-2 LOCE except for the hot leg temperature being 12°F below the desired 598°F.

51687 (NUREG—0603) **Comments on the NRC Safety Research Program budget.** (Nuclear Regulatory Commission, Washington, DC (USA). Advisory Committee on Reactor Safeguards). Jul 1979. 42p. C .

This report includes comments on the budget levels and program plans for the supplemental request for FY 1980 to support research related to the accident at Three Mile Island, Unit 2 (TMI) as well as for the FY 1981 Budget. For both budgets, the funding levels considered by the ACRS are the original requests by RES and the Budget Review Group (BRG) markup as of July 10, 1979. In its current review of the NRC research program, the ACRS has given special attention to both the short- and long-term implications of the TMI accident and their significance to research for both the short- and long-term research programs.

51688 (NUREG/CP—0006) **Review group meeting on two-phase flow instrumentation.** Hsu, Y.Y. (ed.). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). May 1979. 465p. (CONF-780362—). NTIS, PC A20/MF A01.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

On March 13—14, 1978, an Instrumentation Meeting was held at Rensellaer Polytechnic Institute (RPI) in Troy, New York, to discuss the progress of Two Phase Flow Instrumentation research and development by various NRC contractors. Many novel techniques and devices such as pulsed neutron activation, film probes, impedance probes, spool pieces, ultrasonic density detectors, droplet velocity measurements, etc., were described. This report is a compilation of the papers presented. (Separate abstracts are included for the individual papers).

51689 (NUREG/CP—0006, pp I.7.1-I.7.20) **Laser—Doppler anemometry technique applied to two-phase dispersed flows in a rectangular channel.** Lee, S.L.; Srinivasan, J. (State Univ. of New York, Stony Brook). May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

A new optical technique using Laser—Doppler anemometry has been applied to the local measurement of turbulent upward flow of a dilute water droplet—air two-phase dispersion in a vertical rectangular channel. Individually examined were over 20,000 droplet signals coming from each of a total of ten transversely placed measuring points, the closest of which to the channel wall was 250 μ away from the wall. Two flows of different patterns due to different imposed flow conditions were investigated, one with and the other without a liquid film formed on the channel wall. Reported are the size and number density distribution and the axial and lateral velocity distributions for the droplets as well as the axial and lateral velocity distributions for the air.

51690 (NUREG/CP—0006, pp I.10.1-I.1.14) **Investigation of post-CHF heat transfer for water-cooled reactor application and development of two-phase flow instrumentation.** Chen, J.C.; Sundaram, R.; London, E.J.; Nijhawan, S.; Fei, S.; Delale, C. (Lehigh Univ., Bethlehem, PA). May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

A two-phase loop has been modified to obtain post-CHF heat transfer data with water at system pressures up to 100 psia. Development of a probe to measure non-equilibrium vapor superheat is in progress. A suitable test section for obtaining post-CHF data which will incorporate measurement of vapor superheat is in the design stage. A concept for measuring liquid film thickness in two phase flow has been developed and tested with reasonable success. Optimization of probe geometry is in progress. A suitable method for measuring film velocities is being sought. Present investigation is directed towards the use of hydrogen bubbles as tracers.

51691 (NUREG/CP—0006, pp I.11.1-I.11.56) **Advanced instrumentation for reflood studies: algorithm development and impedance probe air—water testing. Two-phase flow instrumentation midyear budget review meeting, March 21, 1978.** Jallouk, P.A.; Leavell, W.H.; Shahrokhi, F.; Hardy, J.E. May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

Studies on two-phase flow instrumentation for LWR reflooding experiments are discussed. The studies covered algorithm development and air—water testing of impedance probes. Measurement methodology, a computer generated transient test, and an air—water transient test are described.

51692 (NUREG/CP—0006, pp I.17.1-I.17.47) **System for recording and displaying two-phase flow topographies.** Cary, C.N.; Block, J.A. (Creare, Inc., Hanover, NH). May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

A system of hardware and software has been developed and used to record and display in various forms details of the countercurrent flow topographies occurring in a scaled Pressurized Water Reactor downcomer annulus. An array of 288 conductivity sensors was mounted in a 1/15 scale PWR annulus. At each moment in time, the state of each probe indicates the presence or absence of water in this immediate vicinity. An electronic data acquisition system records the states of all probes 108 times per second on magnetic tape; software routines retrieve the data and reconstruct visual analogs of the flow topographies. The instantaneous two-phase state of the annulus at each instant can be displayed on a hard copy plotter or on a CRT screen. By synchronizing a camera drive with the CRT display, 16mm films have been made recreating the flow process at full speed and at various slow motion rates. All data obtained are stored in computer files in numerical form and can be subjected to various types of quantitative analysis to assist in advanced code development and verification.

51693 (NUREG/CR—0607) **Coupled fluid-structure method for pressure suppression analysis.** McMaster, W.H.; Norris, D.M. Jr.; Goudreau, G.L.; Quinones, D.F.; Gong, E.Y.; Moran, B.; Macken, N.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). May 1979. Contract W-7405-ENG-48. 97p. (UCRL—52620). P 05/MF A01.

An effective method is described for fluid-structure coupling for application in blowdown suppression analysis in boiling-water reactors. A computer program couples an incompressible, Eulerian fluid algorithm with a finite element shell algorithm. The fluid algorithm provides a trial velocity field using the Navier—Stokes equations that, at each time step, is corrected iteratively to satisfy the incompressibility condition and fluid-structure interface compatibility. The code is verified by comparing calculations of classical problems and experiments. Computer simulations of air blowdown and steam chugging in pool-suppression geometries are also presented.

51694 (NUREG/CR—0609) **Power-Cooling-Mismatch Test Series fuel rod material properties data report.** Kerwin, D.K.; Novick, A.H.; Olsen, C.S. (Idaho National Engineering Lab., Idaho Falls (USA)). May 1979. Contract EY-76-C-07-1570. 84p. (TREE—1331). Dep. NTIS, PC A05/MF A01.

The physical, chemical, mechanical, and metallurgical properties of the Power-Cooling-Mismatch (PCM) Test Series fuel rod components are presented. These data were obtained from examinations and tests of representative unirradiated fuel rod materials, and are necessary to understand and evaluate both fuel rod behavior during irradiation testing in the PCM Test Series, and the posttest conditions of the various fuel rod materials.

51695 (NUREG/CR—0661(Vol.9)) **Light Water Reactor Safety Research Program. Quarterly report, July—September 1978.** (Sandia Labs., Albuquerque, NM (USA)). Apr 1979. Contract EY-76-C-04-0789. 111p. (SAND—79-0359(Vol.9)). P 06/MF A01.

Progress in studies on LWR core meltdown phenomena are reported under the following headings: molten core/conrete interactions, steam explosion phenomena, statistical analysis, and UHI RELAP model development.

51696 (NUREG/CR—0688) **Reactor safety research programs. Quarterly progress report, October 1—December 31, 1978.** Agrawal, A.K.; Cerbone, R.J.; Jones, O.C. Jr.; Sastre, C.; Schweitzer, D.G.; van Rooyen, D. (Brookhaven National Lab., Upton, NY (USA)). Mar 1979. Contract EY-76-C-02-0016. 205p. (BNL-NUREG—50978). P 10/MF A01.

Current activities and technical progress are reported for the following projects: Gas Reactor Safety Evaluation; THOR Code Development; Code Review; SSC Code Development; LMFBR and LWR Safety Experiments; Fast Reactor Safety Code Validation; and Stress Corrosion Cracking of PWR Steam Generator Tubing.

51697 (NUREG/CR—0757) **Fuel rod material behavior during Test PCM-1.** Cook, B.A. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1979. Contract EY-76-C-07-1570. 67p. (TREE—1333). P 04/MF A01.

The analysis is presented of the fuel rod materials behavior based on the postirradiation examination of the Test PCM-1 fuel rod from the Power-Cooling-Mismatch (PCM) Test Series. The test objective was to evaluate the behavior of a single pressurized water reactor (PWR) type fuel rod subjected to film boiling operation at high power following rod failure. The failure mechanisms and subsequent breakup of the fuel and cladding are discussed. The fuel rod cladding temperature profile is determined by metallographic examination of cladding microstructures and calculations based on kinetic correlations of the cladding external surface reaction layers with the duration of film boiling. Cladding-coolant and cladding-fuel interactions are investigated by metallographic and microprobe examination and chemical analysis of the cladding. Fuel restructuring and chemical changes are also addressed.

51698 (NUREG/CR—0814) **Experiment data report for Semiscale Mod-3 Lower Plenum Injection Test S-07-8 (baseline test series).** Sackett, K.E.; Gillins, R.L.; Pack, D.R. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1979. Contract EY-76-C-07-1570. 251p. (TREE—1228). P 12/MF A01.

Recorded test data are presented for Test S-07-8 of the Semiscale Mod-3 baseline test series. This test is one of several Semiscale Mod-3 experiments conducted to investigate the thermal and hydraulic phenomena accompanying a hypothesized loss-of-coolant accident in a pressurized water reactor (PWR) system. Test S-07-8 was conducted from initial conditions of 15.7 MPa and 556°K to investigate the response of the Semiscale Mod-3 system to a blowdown transient following a simulated double-ended off-set shear of the broken loop cold leg piping. The specific objective of this test was to provide reference data to evaluate integral blowdown and reflood behavior during a 200% cold leg break with emergency core coolant (ECC) injection into the vessel lower plenum of the Mod-3 system.

51699 (NUREG/CR—0817) **Multirod burst test program. Progress report, January—March 1979.** Longest, A.W. (Oak Ridge National Lab., TN (USA)). Aug 1979. Contract W-7405-ENG-26. 41p. (ORNL/NUREG/TM—323). P 03/MF A01.

Posttest examination and analysis of the B-3 test continues. Preliminary burst strain measurements indicate that B-3 burst strains are, on the average, ~ 35% greater than the B-1 burst strains. The same fuel simulators were used in the two tests. The lower heating rate in B-3 probably caused a more uniform local temperature distribution and, thus, greater burst strain than in the B-1 test. Shakedown and demonstration tests of the new shroud and fuel pin simulator (FPS) temperature control systems are in progress in the multirod test facility and will be followed by similar testing and subsequent use in the single-rod facility. A four-rod bundle (B4ST) was assembled and is being used for the tests in the multirod facility. The test findings and conclusions reached are summarized in this report and indicate satisfactory progress. A detailed description of the control systems is also given. Single-rod test equipment, including two new flange units and a new test vessel, is being readied for a new series of single-rod tests incorporating a heated shroud. Assembly of B-4 FPSs was completed, and the as-built data are summarized in this report. It was decided to place the B-4 simulators in storage until heated-shroud single-rod test data can be obtained and used in determining test conditions for B-4. Preparations are being made to permit the start of FPS assembly for 8 x 8 bundle B-5 early as May 1, 1979.

51700 (NUREG/CR—0820) **Advanced Reactor Safety Research Division. Quarterly progress report, January 1—March 31, 1979.** Romano, A.J. (comp.). (Brookhaven National Lab., Upton, NY (USA)). May 1979. Contract EY-76-C-02-0016. 135p. (BNL-NUREG—51014). P 07/MF A01.

The Advanced Reactor Safety Research Programs Quarterly Progress Report describes current activities and technical progress in the programs sponsored by the USNRC Division of Reactor Safety Research. The projects reported each quarter are the follow-

ing: HTGR Safety Evaluation, SSC Code Development, LMFBR Safety Experiments and Fast Reactor Safety Code Validation.

51701 (NUREG/CR—0821) **Water Reactor Safety Research Division. Quarterly progress report, January 1—March 31, 1979.** Romano, A.J. (comp.). (Brookhaven National Lab., Upton, NY (USA)). May 1979. Contract EY-76-C-02-0016. 53p. (BNL-NUREG—51015). P 04/MF A01.

The Water Reactor Safety Research Programs Quarterly Report describes current activities and technical progress in the programs sponsored by the USNRC Division of Reactor Safety Research. The projects reported each quarter are the following: LWR Thermal Hydraulic Development, RAMONA Code Evaluation, TRAC Code Assessment, and Stress Corrosion Cracking of PWR Steam Generator Tubing.

51702 (NUREG/CR—0855) **Reactor safety research programs. Quarterly report, January 1—March 31, 1979.** Hooper, J.L. (comp.). (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1979. Contract EY-76-C-06-1830. 171p. (PNL—3040-1). P 08/MF A01.

Progress is summarized in the following LWR safety-related studies: (1) ultimate heat sink performance; (2) verification of steady-state fuel performance computer codes; (3) acoustic emission-flow relationship for pressure vessel monitoring; (4) fuel subassembly procurement and irradiation; (5) steam generator tube integrity prediction; (6) core thermal model development; and (7) integration of nondestructive examination reliability and fracture mechanics. (HDR)

51703 (NUREG/CR—0864) **Physics of reactor safety. Quarterly report, January—March 1979.** (Argonne National Lab., IL (USA)). May 1979. Contract W-31-109-ENG-38. 45p. (ANL—79-37). P 03/MF A01.

This Quarterly progress report summarizes work done during the months of January—March 1979 in Argonne National Laboratory's Applied Physics and Components Technology Divisions for the Division of Reactor Safety Research of the US Regulatory Commission. The work in the Applied Physics Division includes reports on reactor-safety research and technical coordination of the RSR safety analysis program by members of the Reactor Safety Appraisals Group, Monte Carlo analysis of safety-related critical assembly experiments by members of the Reactor Computations Group, and planning of safety-related critical experiments by members of the Zero Power Reactor (ZPR) Planning and Experiments Group. Work on reactor core thermal-hydraulics was performed in ANL's Components Technology Division.

51704 (NUREG/CR—0868) **Nuclear reactor safety. Quarterly progress report, January 1—March 31, 1979.** Jackson, J.F.; Stevenson, M.G. (Comp.). (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 188p. (LA—7867-PR). P 09/MF A01.

Progress in reactor safety research is summarized. LWR studies include TRAC code development for thermal-hydraulic analysis of accidents, containment systems evaluation, and safety experiments. LMFBR studies include SIMMER code development and applications, modeling of core disruptive accidents and safety test facilities studies. HTGR safety studies cover fission product release and transport, structural evaluation, phenomena modeling, systems analysis, and accident delineation. GCFR studies are focussed on core disruptive testing.

51705 (NUREG/CR—0897) **Steam—Water Mixing and System Hydrodynamics Program. Quarterly progress report, January 1—March 31, 1979.** Collier, R.P.; Bishop, T.A.; Dworak, J.A.; Flanigan, L.J.; Kurth, R.E.; Liu, J.S.; Segev, A. (Battelle Columbus Labs., OH (USA)). Jun 1979. Contract EY-76-C-06-1830. 71p. (BMI—2029). Dep. NTIS, PC A04/MF A01.

During this quarter analysis included detailed analytic development of I* scaling for annular geometries, continued development of the condensation and vaporization model, continued development of the discontinuous delivery model, and completion of a study of results from tests with distorted annulus lengths. Experimental work this quarter included flooding tests in a simple tube model and condensation and vaporization tests in a heated flat plate model. Design and fabrication of two new instrumentation systems continued during the quarter. Data from previous flooding tests at 1/15- and 2/15-scale were reorganized in a consistent format to facilitate access for model development. A new statistical technique for data correlation was developed, and a Status Report on ECC Penetration Scaling Research was issued.

51706 (ORNL/TM—6851) **Breeder Reactor Safety and Core Systems Programs progress report for October—December 1978.** Fontana, M.H.; Wantland, J.L. (Oak Ridge National Lab., TN (USA)). Aug 1979. Contract W-7405-ENG-26. 111p. AT.

This report covers progress made during October—December 1978 by the Breeder Reactor Safety and Core Systems Programs at Oak Ridge National Laboratory (ORNL). Topics discussed are program coordination, thermal—hydraulic out-of-reactor safety (THORS) analysis and data evaluation, THORS Facility Operation Sodium Boiling Test (SBT) Facility, analytical models for energetics accommodation, environmental assessment of alternate Fast Breeder Reactor (FBR) fuels, model evaluation of breeder reactor radioactivity releases, Nuclear Safety Information Center (NSIC), central computerized data base for breeder reactor safety codes, and breeder reliability data analysis center.

51707 (PB—289111) **Fission product transport analysis. Quarterly progress report, 1 October—31 December 1977.** Gieseke, J.A.; Baybutt, P.; Denning, R.S.; Jordan, H.; Jung, R.G. (Battelle Columbus Labs., OH (USA)). Aug 1978. Contract NRC-04-76-293-02. 18p. Y A02/MF A01.

This is a quarterly progress report about improving the TRAP-PWR/BWR code and performing the sensitivity analyses for terminated LOCA's, and performing thermal-hydraulic analyses of various postulated meltdown accident sequences for BWR's. These calculations were for the purpose of determining ranges of temperatures and flow rates that must be covered by the deposition models being added to the TRAP-MELT code. The results of these two major technical efforts are discussed individually.

51708 (PB—289121) **A two-dimensional fluid finite element. Final report, 1 October 1976—30 September 1977.** (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Mechanical Engineering). Oct 1978. Contract AT(49-24)-0366. 84p. Y A05/MF A01.

Reliable information is needed to assess the structural integrity of a heat transport system (piping and components) in a nuclear reactor following a possible core disruptive accident. This information can also be used to reduce possible costly overdesigns and to achieve a high level of confidence in the design. The finite element method is ideally suited for this task, as it not only possesses all the versatility of the finite difference method but it also offers a practical means of handling irregularities in geometry, boundary conditions and field properties. A two-dimensional fluid finite element compatible with the solid elements in the ADINA finite element program was developed for the analysis of wave propagation in fluid and fluid-structural systems. The fluid element can model inviscid compressible fluids with constant bulk modules. Although the final discretized equation of motion is valid for general loading and displacement conditions, the numerical computations only admit relatively small fluid displacements unless mesh rezoning would be used. The fluid element is developed in the first part of the report. The second part contains a selected number of sample analyses to show some of the current solution capabilities. A copy of the user's manual is also included. (Portions of this document are not fully legible)

51709 (PB—289543) **Anticipated transients without scram for light water reactors. Volume 3. Staff report.** (Nuclear Regulatory Commission, Washington, DC (USA)). Dec 1978. 199p. Y A09/MF A01.

On the basis of new information, the NRC staff reevaluated recommendations in the first two volumes of NUREG-0460. The staff now believes that a numerical safety objective is not satisfactory for use in nuclear regulatory decision-making at this time, although quantitative risk assessments are valuable supplements to the engineering evaluation and judgment of the appropriateness of alternative plant modifications for ATWS. This volume considers alternative plant modifications for ATWS, ranging from none to those needed to satisfy the criteria in NUREG-0460, Volumes 1 and 2. The corresponding degrees of assurance of safety the modifications are judged to provide were analyzed. The staff has selected a mix of ATWS prevention and mitigation measures for several classes of nuclear power plants that will provide an acceptable level of safety. Subject to confirmatory generic analyses, the staff has concluded, for plants now operating or under construction, that these measures would provide substantial additional protection which is required for the public health and safety.

51710 **Dynamics analysis of reactor coolant systems under LOCA conditions.** Kassawara, R.P.; Bushman, F.H. (Combustion Engineering, Inc., Windsor, CT (USA)). pp v.F p.F4/1 1-16 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

This paper presents a rigorous analysis of a pressurized water reactor coolant system subjected to postulated break in the primary coolant piping. The procedures described include structural modeling and analytical techniques for a non-linear time history dynamic analysis of a three dimensional coupled model of the reactor coolant system including details of the reactor interials, pressure vessel, supports and piping. The dynamic analysis is performed to determine the response of the reactor coolant system supports to the simultaneous effects of pipe break thurst and external and internal horizontal and vertical asymmetric pressure loads applied to the reactor vessel and internals as a consequence of the postulated pipe rupture.

51711 (TFBP-TR—238) PBF-LOCA test series, Test LOC-3: quick look report. Yackle, T.R.; Waterman, M.E.; McKie, L.L. (Idaho National Engineering Lab., Idaho Falls (USA)). Jul 1979. Contract EY-76-C-07-1570. 66p. P 04/MF A01.

The preliminary results are presented of the PBF-LOCA Test LOC-3 performed in the Power Burst Facility test reactor at the Idaho National Engineering Laboratory on June 27, 1979. The test was designed to simulate conditions that could exist during an accident resulting from a double-ended cold leg break in a pressurized water reactor (PWR) core.

51712 (TFBP-TR—315) PBF/LOFT Lead Rod Program Tests LLR-3, -4, -5 quick look report. Varacalle, D.J. Jr.; Garner, R.W. (Idaho National Engineering Lab., Idaho Falls (USA)). Apr 1979. Contract EY-76-C-07-1570. 97p. P 05/MF A01.

The preliminary results are presented of the PBF/LOFT Lead Rod (LLR) Program Tests LLR-3, LLR-4, and LLR-5 conducted in the Power Burst Facility Test Reactor in the Idaho National Engineering Laboratory. Test LLR-3 was conducted on February 28, 1979; Test LLR-5 was conducted on March 24, 1979; and Test LLR-4 was conducted on March 30, 1979. The PBF/LLR Tests were designed to simulate the test conditions for LOFT loss-of-coolant experiments (LOCEs) tests L2-3 through L2-5.

51713 (UCID—18127) Summary of boiling water reactor licensees' commitments to install recirculation pump trip systems. Latorre, V.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.; EG and G, Inc., San Ramon, CA (USA). Energy Measurements Group). Jul 1979. Contract W-7405-ENG-48. 23p. P 02/MF A01.

This report summarizes the commitments of boiling water reactor Licensees to a request by the US Nuclear Regulatory commission for the installation of recirculation pump trip systems in those nuclear power plants that do not currently have such systems. The Licensee's schedules for system implementation, emergency procedures development, and operator training are reviewed.

51714 Accident progression for a loss-of-heat-sink with scram in a liquid-metal fast breeder reactor. Bari, R.A.; Ludewig, H.; Pratt, W.T.; Sun, Y.H. (Brookhaven National Lab., Upton, NY). *Nucl. Technol.;* **44**: No. 3, 357-380(Aug 1979).

An analysis of a slow core meltdown in a liquid-metal fast breeder reactor was performed for the conditions of loss-of-heat-sink following neutronic shutdown. Simple models were developed for the prediction of phase changes and/or relocation of the core materials, including fuel, coolant, cladding ducts, control rod absorber material (B_4C), and plenum gases. The sequence of events was accounted for, and the accident progression was described up to the point of recriticality. The neutronic behavior of the disrupted core was analyzed in r-z geomertry with a static transport they code (TWOTRAN). For most scenarios assessed, the reactor is expected to become recritical, although large ramp rates are not anticipated.

51715 Effect of fluid-to-structure heat transfer on the structural damage potential to a liquid-metal fast breeder reactor. Hakim, S.J.; Abramson, P.B. (Argonne National Lab., Argonne, IL). *Nucl. Technol.;* **44**: No. 3, 390-400(Aug 1979).

Deterministic calculations simulating a hypothetical accident in a liquid-metal fast breeder reactor that leads to a hydrodynamic disassembly of the core have been carried out to estimate the system's damage potential due to the vapor-pressure-driven expansion of molten core material and its dependency on the heat transfer to the remaining structure. These calculations ignored the effect on the work potential of sodium left in the core during the disassembly. Results indicate that steel cladding in the upper axial blankets and fission gas plenum acts as a thermodynamic energy sink that could reduce the total thermodynamic work energy by between one and two orders of magnitude, provided little or no sodium is present in the core at the time of interaction. These results have been found to be insensitive to the rate of heat transferred from the molten fuel to the molten steel that comprises the molten core material.

51716 Evaluation of the thermal-hydraulic and fuel rod thermal and mechanical deformation behavior during the first Power Burst Facility nuclear blowdown tests. MacDonald, P.E.; Broughton, J.M.; Spore, J.W. (EG & G Idaho, Inc., Idaho Falls). *Nucl. Technol.;* **44**: No. 3, 401-410(Aug 1979).

A preliminary evaluation was made of the results from the LOC-11 nuclar blowdown tests conducted in the Power Burst Facility. The objective of the LOC-11 tests was to measure the thermal and mechanical deformation behavior of pressurized and unpressurized fuel rods exposed to a blowdown (coolant depressurization) similar to that expected in a pressurized water reactor (PWR) during a hypothesized double-ended cold-leg break. Incipient fuel rod cladding collapse and swelling occurred during Test LOC-11C, when the two unpressurized and two pressurized PWR-type rods were exposed to a system blowdown with measured cladding temperatures increasing to 1030 K. To better understand the test results and to evaluate prediction capability, RELAP4-calculated coolant thermal-hydraulic and fuel rod thermal behavior and FRAP-T4-calculated fuel rod mechanical deformation behavior were compared with the test LOC-11C data. The RELAP4 posttest calculations of coolant behavior generally agreed well with the measured coolant behavior; however, the calculated cladding surface temperatures were ~ 50 K greater than measured. The FRAP-T4 calculations of cladding deformation using best-estimate models slightly overpredicted the observed ballooning of the pressurized rods and underpredicted the collapse of the unpressurized rods.

51717 EFLOD code for reflood heat transfer. Gay, R.R. (Rensselaer Polytechnic Inst., Troy, NY). *Nucl. Technol.;* **44**: No. 2, 246-257(Jul 1979).

A computer code called EFLOD has been developed for simulation of the heat transfer and hydrodynamics of a nuclear power reactor during the reflood phase of a loss-of-coolant accident. EFLOD models the downcomer, lower plenum, core, and upper plenum of a nuclear reactor vessel using seven control volumes assuming either homogeneous or unequal-velocity, unequal-temperature (UVUT) models of two-phase flow, depending on location within the vessel. The moving control volume concept in which a single control volume models the quench region in the core and moves with the core liquid level was developed and implemented in EFLOD so that three control volumes suffice to model the core region. A simplified UVUT model that assumes saturated liquid above the quench front was developed to handle the nonhomogeneous flow situation above the quench region. An explicit finite difference routine is used to model conduction heat transfer in the fuel, gap, and cladding regions of the fuel rod. In simulation of a selected FLECHT-SET experimental run, EFLOD successfully predicted the midplane maximum temperature and turnaround time as well as the time-dependent advance of the core liquid level. However, the rate of advancement of the quench level and the ensuing liquid entrainment were overpredicted during the early part of the transient.

51718 Size effect in damping caused by water submersion. Dong, R.G. (Lawrence Livermore Lab, Univ of Calif). *J. Struct. Div., Am. Soc. Civ. Eng.;* **105**: No. 5, 847-857(May 1979).

An important effect of water submersion on dynamic response of a structure is the increase in effective damping. The dynamic response of submerged structures is of interest to the nuclear power industry for reasons of operational safety during seismic and other dynamic excitations. The added damping contribution that results from the viscosity of water and the dependence of the contribution on structural size are examined. Other factors considered are the applicable range of viscous damping with respect to displacement amplitude and, as far as damping is concerned, how far must neighboring members be from each other to respond as if in open water. An expression is derived for relating the damping value to structural size. Estimated added-damping values for representative fuel elements, fuel bundles, and main steam-pressure-relief-valve lines that are based on the derived expression for added damping are given. 14 refs.

51719 Sensitivity study on the damage potential of a liquid-metal fast breeder reactor core disassembly. Ostensen, R.W. (Sandia Labs., Albuquerque, NM). *Nucl. Technol.;* **43**: No. 3, 301-313(May 1979).

In a core disruptive accident in a liquid-metal fast breeder reactor, rearrangement of core materials may lead to a prompt critical excursion. Damage to the primary containment, especially the head seals and head bolts, caused by the subsequent core disassembly is a primary concern of hypothetical accident analysis. A systematic study has been performed to evaluate the sensitivity of that damage in a commercial size reactor to various uncertainties. The damage is very insensitive to the equation-of-state of the fuel but highly sensitive to the reactivity ramp rate through prompt critical. From the point of view of vessel damage calculations, these results indicate that there is little incentive to improve our equation-of-state data on unirradiated mixed-oxide fuel.

51720 Effects of grain boundary fission gas on transient fuel behavior. DiMelfi, R.J.; Deitrich, L.W. (Argonne National Lab., IL). *Nucl. Technol.;* **43**: No. 3, 328-337(May 1979).

The microstructural response of fast breeder reactor fuel to accident transients has been analyzed. Based on experimental results, fuel response can be classified as either basically brittle or basically ductile in nature. In the analysis, the type of response is assumed to be determined by the behavior of grain boundary fission gas. The transient variables taken into consideration are the temperature, heating rate, the mean gas content per bubble, mean bubble spacing in the grain boundary, and the stresses resolved normal to grain boundaries containing gas bubbles. By calculating the rate at which a grain boundary bubble grows as a sharp crack and comparing it to the rate of bubble growth by mass transport, a criterion is established to predict the characteristic response of a fuel sample to a specified thermal transient. A swelling threshold time is also determined for the case of ductile fuel behavior. Tensile stresses applied to the grain boundary are shown to enhance brittle behavior, and compressive

stresses are shown to enhance ductile behavior. When average values of the relevant variables are extracted from a number of fission gas release and direct electric heating experiments and are used in the above calculation, fuel behavior predictions for these tests are found to correspond well with the experimental results.

51721 Radiation protection in nuclear power plants and the fuel cycle. London, England; British Nuclear Energy Society (1978). 251p. (CONF-7811132—P1). Inst. of Civil Engineers, London, England.

From Conference on radiation protection in nuclear power plants and the fuel cycle; Bristol, UK (27 Nov 1978).

Separate abstracts for the individual papers presented may be found inthe Energy Data Base.

51722 Radiation protection in nuclear power plants and the fuel cycle. London, England; British Nuclear Energy Society (1978). 255p. (CONF-7811132—P2). Inst. of Civil Engineers, London, England.

From Conference on radiation protection in nuclear power plants and the fuel cycle; Bristol, UK (27 Nov 1978).

Separate abstracts for the individual papers presented may be found in the Energy Data Base.

51723 Validation of explosion containment codes: analysis of bare rigid models in the COVA programme. Benuzzi, A.; Delaval, M.; Jones, A.; Yerkess, A. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Persson, B. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)); Cameron, I.G.; Hoskin, N.E. (Ministry of Defence, Aldermaston (UK). Atomic Weapons Research Establishment); Lancefield, M.J. (UKAEA, Winfrith. Atomic Energy Establishment). pp E2/3 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51724 Dynamic loadings of sodium-water reactions in LMFBR and fusion power designs. Chan, C.K. (California Univ., Los Angeles (USA). Dept. of Energy and Kinetics). pp E5/2 1-9 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

In liquid metal fast breeder reactor and lithium cooled fusion reactor, a sodium loop is being proposed to transfer heat from the primary coolant loop to the steam turbine cycle. Although by careful design and quality assurance programs, the probability for steam generator tube failure can be minimized, failure will still occur. The direct contact of sodium and water sould cause a chemical reaction where hydrogen and sodium compounds are produced. This paper presents an evaluation of the potential hazards as a result of such a reaction. The sodium-water reaction is explosive in nature with highly corrosive chemical by-products. An analytical method is developed to investigate the extent of the reaction zone and the propagation of the pressure wave in the sodium system.

51725 structural dynamics in LMFBR containment analysis - a brief survey of computational methods and codes. Chang, Y.W. (Argonne National Lab., IL (USA)). pp E1/1 1-15 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

In recent years, the use of computer codes to study the response of primary containment of large, liquid-metal fast breeder reactors (LMFBR) under postulated accident conditions has been adopted by most fast reactor projects. This paper gives a brief survey of the computational methods and codes available for LMFBR containment analysis. The various numerical methods commonly used in the computer codes are compared. It provides the reactor engineers up-to-date information on the development of structural dynamics in LMFBR containment analysis. It can also be used as a basis for the selection of the numerical method in the future code development.

51726 Modeling of reactor internals in the HCDA analysis. Chang, Y.W.; Gvildys, J. (Argonne National Lab., IL (USA)). pp E2/2 1-13 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

This paper deals with the modeling of the reactor internals in the HCDA analysis. Internals which must be included in the analysis are core blankets, shields, fission-gas plenum, core barrel and core support structure. This is because they are placed so close to the reactor core that the expansion of the reactor core is strongly influenced by the presence of these internals. The general approach to the mathematical model is to incorporate, to the extent possible, the actual geometries and the correct material properties. In the HCDA analysis, the mechanism for producing mechanical damage to the primary containment is the expansion of the reactor core. Therefore, it is very important to model the core gas properly. The inertia of the core gas must be included. Four to six zones are needed for a proper representation of the core. The core blankets and shields can also be represented by zones while core barrels must be modeled as thin shells. The core support structure can be modeled either as a lattice of shell elements similar to the actual structure or as an elastic-plastic solid continuum material with overall bending stiffness equivalent to the actual structure. However, the connection between the core support and the reactor vessel must be modeled properly. Finally, to demonstrate the validity of the mathematical model, the results of comparisons with experimental data are presented.

51727 Hydrodynamic and elastoplastic structural analysis of fast breeder reactor core accident. Chedmail, J.F.; Dubois, J.; Rouvray, A.L. de (Engineering System International S.A., 20 rue Saarinen, F-94150 Rungis-Silic, France); Fortunato, M. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Service d'Etude et de Developpement des Coeurs). pp E1/9 1-10 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

This paper describes the principles and examples of applications of an explicit Lagrangian coupled finite difference-finite element code HEMP-ESI developed in order to calculate the structural consequence of hypothetical core disruptive accidents (HCDA) in nuclear reactors. Two examples of simulation show the applicability of the method to nuclear reactor core safety analysis (test problem): 1) core explosion in a loop-type reactor including a shell containment. The calculation shows the energy absorbing function of the shell and enables the evaluation of the forces acting on the reactor containment. 2) Hypothetical Core Disruptive Accident in a fast breeder reactor. The calculation shows the main features of this accident.

51728 Fail-safety of LMFBR steam generator systems. Chopra, P.S (Argonne National Lab., IL (USA)). pp E5/3 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51729 Analysis of LMFBR containment response to an HCDA using a multifield Eulerian code. Chu, H.Y.; Chang, Y.W. (Argonne National Lab., IL (USA)). pp E1/2 1-10 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

This paper describes a computer code, MICE (Multifield Implicit Continuous-fluid Eulerian Containment Code), which is being developed at Argonne National Laboratory (ANL) for the analysis of containment response to a hypothetical core distruptive accident (HCDA). The code is applicable to multifield flow problems where material fields are allowed to have penetrations. Reactor structures are treated as axisymmetrical shells and solved by the large-displacement and small-strain theory. Two sample problems have been performed using the MICE code. The first illustrates the relative motions of the material fields after the initiation of a core disassembly accident. Core support structure and core barrel are modelled as rigid obstacles. The second demonstrates the interactions between fluid and structures. Core expansion and reactor wall deformation at several instants are shown by the computer-generated film plots.

51730 Analysis of mechanical HCDA consequences with ARES for demonstration of primary containment integrity in SNR-300. Doerbecker, K.; Kellner, W.; Lauber, H. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). pp E1/5 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51731 LMFBR typical impulsive loading characterization and its application to simplified structural models. Giuliano, V.; Lazzeri, L. (SAIGE S.p.A., Via P. Pesce 5, 1-16151 Genova-Sampierdarena, Italy). pp E2/7 1-16 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The aim of this paper is a discussion of the analytical methods which have been used for the dimensioning of the support structure of a LMFBR tank to cope with the explosive accident. Particular reference is given to fast but comprehensive methods developed in order to assist the designer in the preliminary stage of the design. The three main steps necessary to define a general arrangement of the structure can be described as follows: (1) simplified equivalent characterization of the impulsive loading, (2) Characterization of the elastic plastic behaviour of simple structural elements, (3) parametric absorption of plastic energy with comparison with allowable strains. Each step has been extensively studied and the main results obtained in terms of the analytical methods developed and typical applications are presented and discussed. For step 1) a modified version of NONSAP code has been extensively used in order to analyze and to compare the effect of some different time histories of impulsive loading with that of a simplified 'equivalent' impulsive loading. For step 2) an original computer code (CARPA) has been developed and used for the elastic plastic analysis of beams of different sections. For step 3) a simple original computer code (CAT) based on an analytical integration technique, has been developed and used to evaluate parametric absorption of plastic energy correlated to the large displacements of the supported tank. Applications of these methods and codes are given.

51732 Main aspects of the design of a support structure of a LMFBR with particular reference to the explosive accident consequences. Giuliano, V.; Lazzeri, L. (SAIGE S.p.A., Via P. Pesce 5, 1-16151 Genova-Sampierdarena, Italy). pp E2/8 1-15 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The aim of this paper is a review of the main aspects of the design of a support structure of a LMFBR tank, with particular reference to the analysis of the non-linear dynamic behaviour of the structure in the plastic range under the effect of an explosive accident within the tank. The structure is composed by a L-shaped flange, which supports the tank, connected by means of nine square beams to a rigid box-type ring, fixed to the concrete. The plug of the tank is connected to the L-shaped figure by means of a group of SS bars. The non-linear dynamic analysis of the explosive accident has been carried out on a lumped mass model, with elastic-plastic elements which simulate main components of the support structure and tank. The impulsive load connected to the explosive accident has been modelled (on the basis of extensive comparative studies carried out) as two triangular pressure impulses acting on the plug and on the botton of the tank. A large amount of results, which describe displacements, velocities and accelerations of the plug, of the tank, and of the support structure, together with the forces and stresses acting on the main structural components are presented and discussed, with particular reference to the influence of the various parameters involved in the analysis.

51733 Subassembly-to-subassembly meltthrough analytical studies. Kulak, R.F.; Kennedy, J.M. (Argonne National Lab., IL (USA)). pp E3/2 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51734 Finite-element formulations for the thermal stress analysis of two- and three-dimensional thin reactor structures. Kulak, R.F.; Kennedy, J.M. (Argonne National Lab., IL (USA)); Belytschko, T.B.; Schoeberle, D.F. (Illinois Univ., Chicago (USA)). pp E3/3 1-13 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

This paper describes finite-element formulations for the thermal stress analysis of LMFBR structures. The first formulation is applicable to large displacement rotation problems in which the strains are small. For this formulation, a general temperature-dependent constituent relationship is derived from a Gibbs potential and a temperature dependent surface. A second formulation is presented for problems characterized by both large displacement-rotations and large strains. Here a set of large strain hypoelastic-plastic relationships are developed to linearly relate the rate of stress to the rate of deformation. These developments were incorporated into two ANL developed finite-element computer codes: the implicit version of STRAW and the 3D Implicit Structural Analaysis code. A set of problems is presented to validate both the 3D and 2D programs and to illustrate their applicability to a variety of problems.

51735 Structural response of large LMFBR head closures to hypothetical core disruptive accidents. Kulak, R.F.; Marciniak, T.J. (Argonne National Lab., IL (USA)); Belytschko, T.B. (Illinois Univ., Chicago (USA)). pp E1/7 1-9 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

A finite-element model was developed to assess the ability of a pool-type LMFBR head closure to sustain an energetic HCDA. From a conceptual representation of an expanded EBR-II type deck. It was determined that there is a reasonable amount of symmetry in the structure that an initial model would consist of a 12°sector. This model accounts for the main structural elements of the closure head: beams, plates, innner ring, in-tank component nozzle and concrete shielding. The mass of the in-tank component was treated as a concentrated mass located at its attachment in the structural members. The ANL-developed SADCAT code was used in this study. The model was used to study the effect of several design variations on the structural response of the deck to an energetic HCDA. Two types of outer boundary conditions were considered to determine the effect on the closure head's displacement and stress levels. In addition to the above study, an analysis was conducted to determine the structural contribution of the concrete shielding.

51736 Structural dynamics studies for single and clustered SNR-300 fuel elements: a comparison of analytical and experimental results. Liebe, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). pp E3/7 1-12 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

Structural damage may occur in liquid metal cooled fast breeder reactors (LMFBR) when local failures escalate to a fast release of excessive thermal energy within one fuel element. Time scales (5 to 50. msec) and peaks of associated pressure pulses (50. to 500. bar) may exceed the burst pressure of the hexagonal wrapper containing the pin-bundle. Though after fuel rupture the pressure level in the vicinity is markedly reduced, still a significant pressure field is propagating through the core. Therefore surrounding subassemblies or control rods are exposed to impulsive differential pressures causing duct flexure as well as local cross section deformation. A theoretical and experimental research program at GfK Karlsruhe investigates the mechanical effects of conservative pressure transients on LMFBR fuel elements. As part of the program this paper describes two computer codes (BEDYN-2, CORE-1) for non-linear structural dynamics of single as well as clustered subassemblies.

51737 Simulation of LMFBR excursion models by means of ICECO. Marchertas, A.H.; Wang, C.Y.; Fistedis, S.H. (Argonne National Lab., IL (USA)). pp E2/5 1-11 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

Some comparisons of transient fluid-structure tests with results from the ICECO containment code have already been published. Additional test data from the same series of experiments have again become available. Thus, the comparison of these more complex models with the ICECO results is the subject of this paper. The experimental data used herein pertain to test models composed of a spherical source within a cylindrical pool of water. The rigid ends of the container are connected by holddown bolts and cylindrical boundaries are made of one or two concentric deformable shells. The space above the surface of the water is occupied by air which may vent during the course of the experiment. In order to gain better insight into this problem, several analytical models with the thin vessel were studied. The principal means of comparison between experiment and analysis for both test configurations was the final deformation of the vessels. Certain pressure and impulse data at specified locations were also available and thus were used for comparison. The correspondence of experimental and analytical results was in general quite good.

51738 Extension of HCDA safety analysis to large PCRV containment structures. Marchertas, A.H.; Fistedis, S.H. (Argonne National Lab., IL (USA)); Bazant, A.P. (Northwestern Univ., Evanston, IL (USA). Dept. of Civil Engineering); Belytschko, T. (Illinois Univ., Chicago (USA)). pp E4/1 1-12 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The prestressed concrete reactor vessel (PCRV) has thus far been applied for nuclear reactor containments involving steady-state loading. This paper, on the other hand, considers the PCRV for the LMFBR containment which must sustain dynamic effects stemming from the Hypothetical Core Disruptive Accident (HCDA). To

perform a feasibility study of such a PCRV, a specialized formulation for transient analysis of such structures was developed. The analytical model of a PCRV is represented in a finite element computer code involving an explicit time-integration procedure. The formulation is particularized for the axisymmetric geometry and includes simulations of tensile cracking of concrete, reinforcement and prestressing capability. The code is applied to the analysis of a PCRV in a possible LMFBR configuration. The code provides a useful tool for evaluating the effect of reinforcement and prestressing on crack propatation. By means of the code, the design parameters can be varied to improve and optimize the PCRV configuration.

51739 Probabilistic models for fuel rod damage during an LWR LOCA. Mattila, L.; Sairanen, R. (Valtion Teknillinen Tutkimuskeskus, Helsinki (Finland)). pp 4/4 1-11 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

A computer model MCRF has been developed for estimating the number of fuel rods puncturing during an LWR LOCA due to the pressure acting over the clad. MCRF is planned to be coupled with the multi-purpose fission product release code ACCREL. It is expected that the MCRF model is best applicable, and also most useful, in cases where the failed rod fraction is in the range 0.1-10%. The reactor core is divided into up to 15 rod groups, each of which consists of an arbitrary number of like fuel rods. The damage fractions in the rod groups and the whole core and their statistical error limits are determined. The program allows the user to choose between two different failure criteria: simple rupture strength vs. rupture temperature curve derived from burst tests, and a more flexible method based on the concept of life fraction integral. In addition to estimating the damage fraction, the program can, as an option, also supply an estimate of flow channel blockage in each rod group. Illustrative test calculations carried out for the Loviisa nuclear power station employing WWER-440 PWR's are described.

51740 Energy source for modeling HCDA bubbles. Ploeger, D.W.; Cagliostro, D.J.; Goodale, T.C. (Stanford Research Inst., Menlo Park, CA (USA). Poulter Labs.). pp E4/2 1-12 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

One concern in the safety analysis of liquid metal fast breeder reactor (LMFBRs) is the release of radioactive core materials to the environment following a hypothetical core distruptive accident (HCDA). The release depends on the transport properties of the expanding, two-phase, fuel-coolant bubble produced during the HCDA and the energy available in the bubble to damage the reactor containment system. Most predictions of the HCDA bubble pressure-volume change relationship assume an isentropic expansion of the bubble material from some known initial state. This work describes the development and characterization of an energy source that models the assumed initial conditions and the subsequent expansion of an HCDA bubble in a simple 1/30-scale model of the Clinch River Breeder Reactor (CRBR). The source is used in a study of the phenomena associated with expanding, rising HCDA bubbles, the transport of radioactive core materials to the cover gas region, and the loading resulting from the impact of the coolant slug with the vessel cover. The results imply that gaswork and slug kinetic energy predictions based on an equilibrium expansion of a superheated liquid may be too high by a factor of two.

51741 Stress and deflection analysis of a typical PWR fuel assembly due to seismic and maximum hypothetical LOCA loading conditions. Ramani, D.T. (Motor-Columbus Ingenieurunternehmung A.G., Baden (Switzerland)). pp D4/1 1-15 of Structural mechanics in reactor technology. Vol. D. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The importance of knowledge of Seismic and LOCA load responses of reactor internals including fuel-assemblies is related to safety and operational requirements in assessing the adequacy, structural integrity and functioning of a nuclear system. The present investigation summarizes the development of a unique method of analysis for predicting the most critical dynamic response of a typical 950 MWe PWR fuel assembly subjected to simultaneous occurrences of seismic and LOCA loads in which individual responses are superimposed directly. The paper discusses mathematical modelling and analysis techniques, whereby important subcomponents of the assembly, such as gapped end springs, upper and lower end fitting, hold-down springd, end box assembly, intermediate grid and slip mechanism, fuel rods and the outer thin box shell, are idealized into a planar two-dimensional multi-degree of freedom lumped mass system using finite element method. Included in the analysis are the adverse effects of non-linearities due to gapped springs and interaction between adjacent impacting assemblies.

51742 Transient dynamic response and stability analysis of reactor core-support barrel due to LOCA pressure pulse loading. Ramani, D.T. (Motor-Columbus Ingenieurunternehmung A.G., Baden (Switzerland)). pp F5/6 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51743 Analysis of hydrodynamic effects of large sodium-water reactions. Sakano, K.; Shindo, Y.; Koishikawa, A.; Maekawa, I. (Nuclear Power Engineering Department, Technology Division, Kawasaki Heavy Industries, Ltd, 4-1, 2-Chome, Hamamatsu-cho, Minato-ku, Tokyo, 105, Japan). pp E5/5 1-12 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

Large leak sodium-water reactions that would occur in a steam generator of LMFBR causes abrupt changes of pressure and velocity of fluid in a secondary sodium system and relief system. These changes exert unsteady forces on piping and components. The estimation of the effect of the pressure and forces is needed to assess the integrity of the system. SOWACS-III code has been developed to predict the pressure, velocity, flow-induced forces and the response of the piping and components to these forces. This paper described SOWACS-III together with its model and method. Results of analyses are also given, the comparison with experimental results of initial pressure spike being included.

51744 CRBRP steam generator modeling techniques for pressure excursions generated by sodium/water reactions. Shimozono, G.S. (Atomics International Div., Canoga Park, CA (USA)). pp E5/8 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51745 Analysis of EBR-II steam-generator system for pressure pulses due to leaks of steam or water into sodium. Srinivas, S.; Chopra, P.S. (Argonne National Lab., IL (USA)). pp E5/4 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

51746 Parametric study of the nonlinear behaviour of complete LMFBR subassembly using the CORTRAN computer code. Zehlein, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). pp E3/8 1-13 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The paper emphasizes the computational aspects of combined analytical-experimental investigations concerning dynamic elasto-plastic deformation of a single fuel subassembly under transverse pressure loading. To simulate the situation within a fast reactor core during a postulated local vapor explosion the cushioning effect of the thin sodium layers between subassemblies has to be included. Therefore a new computer code CORTRAN was developed which combines both a one-dimensional axial squeeze flow model as well as a variable cross-section Timoshenko beam model. The ensuing program structure of the code is described.

51747 Computer simulation of LMFBR piping systems. A-Moneim, M.T.; Chang, Y.W.; Fistedis, S.H. (Argonne National Lab., IL (USA)). pp E4/3 1-14 of Structural mechanics in reactor technology. Vol. E. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

A two-dimensional coupled hydrodynamic-structural response analysis of piping systems is described. Implicit Continuous-Fluid Eulerian (ICE) technique is utilized in the hydrodynamics while a finite-element technique is used in the structural analysis. Different piping components such as elbow, valves, reducers, expansions, heat exchangers, and tees are modelled and coupled with the straight pipe model. An axisymmetric general component model that can be used in modelling valves, reducers, expansions, and heat exchangers is described. At the inlet and outlet region of such component the cross-sectional area may change suddenly or gradually, or may not change at all. Among the options available in this model are deformable exterior walls, interior rigid wall simulation, and tube bundle effect. Sample problems are presented to demon-

strate the capabilities of the method; their results and future developments are discussed.

51748 Ductile failure of thin walled pipes with defects under combination of internal pressure and bending. Darlaston, B.J.L.; Harrison, R.P. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). pp F8/4 1-10 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The purpose of the work is to evaluate the collapse of pipes containing axial defects and subjected to combinations of internal pressure and bending. The paper specifically considers ligament collapse due to applied pressure, collapse due to bending and ligament collapse due to internal pressure in the presence of bending. The major part of the experimental programme was carried out on 3.5 in. diam. mild steel pipes with wall thicknesses 0.064 in. Various lengths of axial defect were assessed for defect depth of 0.044 in., 0.050 in. and full penetration. The machined defects were 0.012 in, wide and nominally flat bottomed. As part of another exercise on depressurisation characteristics, data were obtained on pipes in the range 6 in. to 24 in. The results of the combined bending and pressure tests are presented as the hoop stress at failure for a given bending stress. A design curve has been constructed to show the form of the failure surface in terms of stresses remote from the defect. It has been shown as the defect size decreases the shape of the derived failure curve changes progressively to become geometrically similar to that for the unflawed pipe used as the basis for conventional design curves.

51749 Nonlinear dynamic behaviour of pipe-restraint system. Shimizu, T.; Sato, Y. (Hitachi Ltd., Ibaraki (Japan). Hitachi Research Lab.); Yoshinaga, T. (Hitachi Ltd., Ibaraki (Japan). Hitachi Works). pp F2/5 1-12 of Structural mechanics in reactor technology. Vol. F. Jaeger, T.A.; Boley, B.A. (eds.). Amsterdam, Netherlands; North-Holland (1977).

From 4. international conference on structural mechanics in reactor technology; San Francisco, CA, USA (15 Aug 1977).

The results of an experimental study of pipe whip behavior under simulated BWR conditions. The experiments were aimed at determining whether the assumptions used in the design calculations of the pipe-restraint system were acceptable or not. In the experiment, Type 304 stainless steel pipes (2-inch Sch 80) and U type rod restraints were used. Pipes and restraint strain were measured by strain gauges during blowdowns. Pipe whip behavior was rcorded on a magnetic tape by a VTR instrument. The observation of pipe and restraint dynamic behavior with magnetic tape showed that the first restraint rod effectively absorbed pipe whip energy when a moment arm length was short, but that the secnd restraint rod did not work as well.

ENERGY STORAGE

REFER ALSO TO CITATION(S) 51422

51750 (SAND—79-1504C) **Mechanical energy storage technology development.** Woods, R.O. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 16p. P 02/MF A01.

The project goals include the selection of those mechanical components of flywheel energy storage systems that can be carried to their next stage of evolution by efforts within the scope of the budget; the funding of developmental work treating such components; and the documentation of the state-of-the-art in component technology where such information is scattered or fragmentary. Efforts have treated the followed components: rolling contact bearings; magnetic bearings; composite wheels; composite materials; and seals. Funding has been provided to other agencies for the testing of energy storage systems, and the groundwork has been completed for a program to deal with the problems of vacuum technology.

PUMPED HYDRO

REFER ALSO TO CITATION(S) 51209

FLYWHEELS

REFER ALSO TO CITATION(S) 51889

51751 (AD-A—060586) **Flywheel components for satellite applications. Technical note.** Millner, A.R. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 16 May 1978. Contract F19628-78-C-0002. 145p. Y A07/MF A01.

The following paper studies the possibilities of using high-speed flywheels with magnetic bearings in communications spacecraft. Hardware point designs have been completed for a very low drag bearing and a very efficient, compatible motor generator. Using the results of these designs, a tradeoff study compares these flywheels with combinations of NiCd batteries, NiH_2 batteries, and conventional low-speed momentum wheels. Section I presents the tradeoff studies for flywheels used for energy storage only, for attitude control only, and for combined energy storage and attitude control. The results show that such wheels look excellent for attitude control alone (as high-speed, high-reliability momentum wheels) and attractive for combined power and attitude control, but not much better than NiH_2 for power alone.

51752 (SAND—79-1669C) **Recent spin tests of two composite wagon wheel flywheels.** Miller, A.K. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 12p. P 02/MF A01.

The paper briefly discusses some observations made of spin tests performed on two variations on the Sandia wagon wheel flywheel. In one design, the graphite/epoxy rim was attached to the aluminum hub with twenty-four thin Kevlar-49/epoxy spokes, while in the other design eight thicker graphite/epoxy spokes connected the rim to the hub. The test objective was to compare the dynamic behavior of the two structurally dissimilar flywheels. The tests were limited to speeds less than 22,000 RPM and only moderate torques were applied during the acceleration phase of the tests in an attempt to detect speeds for previously predicted modes of vibration of the flywheel-spin-turbine system. Using proximity sensors, horizontal disturbances of the flywheel hub were detected for speeds less than approxiately 6,000 RPM. These disturbances are believed to be associated with predicted modes of vibration for the flywheel-spin-turbine system. No modes of vibration were sensed for the predicted possible whirl and torsional resonances in the speed range between 6,000 RPM and 22,000 RPM. A squeeze film damper assembly which was attached to the flywheel spindle shaft is believed to have sufficently dampened possible whirl modes so that they were undetectable in the speed range tested. The tests indicated that the squeeze film damper assembly successfully stabilized the flywheel-spin-turbine system when the damper functioned properly; however, low frequency retrograde instabilities were induced into the system by the damper assembly when it was not operated within prescribed parameters.

THERMAL

REFER ALSO TO CITATION(S) 51332

51753 (CONF-790748—1) **DOE/ORNL demonstrations of load management by controlled customer-side thermal energy storage.** Kuliasha, M.A. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 13p. P 02/MF A01.

From Conference on peak load pricing and thermal energy storage; Chicago, IL, USA (15 Jul 1979).

The Division of Electric Energy Systems of the Department of Energy is funding a nationwide demonstration of electric load management through the use of utility-controlled customer-side thermal energy storage for residential space conditioning. These demonstration projects, which are being conducted by utilities under contract to ORNL, are designed to (1) collect reliable load-research data for assessing the impact on the utility system, (2) delineate and solve installation problems, (3) establish maintainability, (4) illuminate customer and utility acceptance, and (5) generate cost data. Ten demonstrations, 5 heat storage and 5 cool storage, are underway. The thermal energy storage systems being demonstrated include ceramic brick, pressurized water, and building structural heat-storage systems, and ice-cool-storage systems. The demonstrations will cover two full conditioning seasons. The results obtained from these demonstrations are expected to be useful to utilities in making local load management decisions, to assist DOE in establishing priorities for R and D efforts in load management, and to provide objective information related to electric-system impact, energy conservation, and the cost-effectiveness of this form of load management.

51754 (ORNL/CSD—39) **Mathematical modeling of phase change processes for latent heat thermal energy storage.** Solomon, A.D. (Oak Ridge National Lab., TN (USA)). Aug 1979. Contract W-7405-ENG-26. 137p. P 07/MF A01.

The discussion is a meld of two areas moving boundary problems of phase-change processes and latent heat thermal energy storage. Each has come into its own in recent years. Interest in moving boundary problems had been relatively dormant from the mid 1950s until the early 1970s when new applications and techniques stimulated a broad and continuing research effort. Latent heat thermal energy storage (LHTES) concepts date back to the early

1950s but have only recently become attractive and worthy of consideration on economic grounds because of the expandng energy crisis. The discussion is in two parts. In the first some aspects of heat transfer and thermal energy storage are reviewed. Part 2 deals with mathematical modeling of phase-change processes and closes with a list of pertinent references. (TFD)

51755 (STUDSVIK/E—1-79/60) **Development and testing of materials for large hot-water reservoirs.** Bergman, J. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 7 Mar 1979. 41p. (In Swedish). U 03/MF A01.

The storage of hot water in large reservoirs makes it possible to utilize waste heat and solar energy as energy sources much more efficiently. Different materials suitable as top coats, insulation materials and diffusion barriers in such a construction were studied. The life-times of tubes made of these materials being in contact with hot water at temperatures of 70°, 80° and 95°C were examined.

51756 (STUDSVIK/ET—78/8) **Heat storage in rocks: description of a project.** Roseen, R.; Agerstrand, T. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 29 Sep 1978. 12p. (In Swedish). U 02/MF A01.

The aim of the project described is to develop a method for heat storage which is applicable for the heating of houses both in urban and rural areas where rigid bedrock exists. In a borehole having a depth of 100 to 150 m a casing tube is installed. The tube is closed at the bottom and is connected with a circulation system to a heat pump in the apartment which is going to be heated. Such a facility is going to be constructed and tested at Studsvik, Sweden. The results obtained with this arrangement will be used to evaluate the usefulness of this technique for heat storage in Sweden.

BATTERIES

DESIGN AND DEVELOPMENT

51757 (EPRI-EM—1059) **Assessment of technical and economic feasibility of zinc/bromine batteries for utility load leveling. Final report.** Putt, R.A. (Gould, Inc., Rolling Meadows, IL (USA). Gould Labs.). May 1979. 256p. P 12/MF A01.

This feasibility study was undertaken to determine the viability of zinc/bromine batteries for utility load-leveling applications. Gould's preliminary comparisons of bromine and chlorine as positive reactants in flowing electrolyte cells led to promising proposals for storing bromine, minimizing self-discharge, controlling zinc dendrites, and developing a cost-effective cell design. These were major shortcomings discovered in previous work by other investigators. Principal accomplishments in this 30-month contract, which included substantial funding by Gould as a program sharing partner, were the following: selecting an organic complexing agent that lowers the free aqueous phase bromine activity, that is stable in the cell environment and that does not present toxicological hazards; selecting a flowing electrolyte system with separate negative and positive solutions stored externally to the cell stack; selecting titanium electrodes, a planar sheet for the zinc negative and porous flow-thru structure for the bromine positive; selecting a micro-porous separator that is inexpensive, commercially available, and performance-proven in lead—acid batteries; identifying conditions for uniform, adherent, nondendritic zinc plating in excess of 200 mAh/cm^2; building and cycling cells and batteries in successive scaleups from 3 Wh to 1.28 kWh that demonstrated the feasibility of meeting utility load-leveling performance requirements, and that uncovered no life-limiting features of the zinc/bromine system; and iteratively developing cost and design studies of a 400-kWh module building block for a 100-MWh load-leveling plant that showed reasonable promise of meeting all technical and economic constraints for this application. 95 figures, 37 tables.

PERFORMANCE AND TESTING

REFER ALSO TO CITATION(S) 51757

51758 (AD-A—060422) **Performance of lead—acid gelled electrolyte batteries in the deep ocean environment. Final report, October 1977—September 1978.** Briggs, W.D. (Civil Engineering Lab. (Navy), Port Hueneme, CA (USA)). Sep 1978. 27p. Y A03/MF A01.

Standard lead—acid batteries with liquid electrolyte experience dramatic capacity losses when charged and discharged under deep ocean conditions. Recently developed commerical lead—acid batteries with gelled electrolyte were tested to determine their performance at high pressure and low temperature. Batteries from three manufacturers were divided into control and test groups. The test groups were modified to allow pressure compensation with white mineral oil. The performance of the test battiers was not degraded by exposure to the mineral oil or high pressure (10,000 psig). An average loss of capacity of 10% was experienced when the batteries were cycled cold (32 degree F) and at pressure (10,000 psig). However, this capacity loss is significantly less than the 35-70% loss experienced in previous tests with standard batteries in similar conditions. Thus, lead-acid batteries with gelled electrolyte were found to be suitable for use in deep ocean conditions in a pressure compensated mode.

51759 (AD-A—060880) **Transient techniques for low frequency battery impedance measurements. Interim report.** Zimmerman, A.H.; Martinelli, M.R. (Aerospace Corp., El Segundo, CA (USA). Ivan A. Getting Labs.). 6 Oct 1978. Contract F04701-78-C-0079. 21p. Y A02/MF A01.

A general formalism is developed for obtaining battery impedances as a function of frequency from the time response to an input current step. As an example, this technique is applied to impedance measurements for a 10-ampere hour nickel cadmium satellite cell. The impedance over the frequency range of 0.5 Hz to 10^6 Hz is indicative of diffusion-controlled cell polarization.

51760 **Mechanism for alkaline cell leakage.** Baugh, L.M.; Cook, J.A.; Lee, J.A. (Ever Ready Co. (Holdings) Ltd., London, England). *J. Appl. Electrochem.;* **8**: No. 3, 253-263(May 1978).

A form of alkaline creepage, other than that governed by electrocapillary phenomena, has been studied on partially immersed negatively polarized electrodes. This extra-creepage is believed to result from concentration gradients generated in the thin spreading film above the intrinsic liquid meniscus by the electrochemical reduction of oxygen and/or water. Consequent transport of water into the spreading film allows it to expand and advance further along the electrode. 16 figures.

MATERIALS, COMPONENTS, AND AUXILIARIES

REFER ALSO TO CITATION(S) 51900

51761 (AD-A—060370) **Some fatigue characteristics of nickel battery plaque. Interim report, November 1977—April 1978.** Fritts, D.H. (Air Force Aero-Propulsion Lab., Wright-Patterson AFB, OH (USA)). Jul 1978. 35p. Y A03/MF A01.

The conductance of sintered nickel battery plaque is experimentally determined as the plaque is being mechanically stressed. The plaque was subjected to bonding fatigue tests and to tensile testing. It was found that the plaque conductance exponentially decreases with bonding fatigue cycling. Also, it was determined that the plaque conductance is a function of its instantaneous state of stress.

51762 **Kinetics of growth of zinc dendrite precursors in zincate solutions.** Moshtev, R.V.; Zlatilova, P. (Bulgarian Academy of Sciences, Sofia). *J. Appl. Electrochem.;* **8**: No. 3, 213-222(May 1978).

By means of microscopic measurements on a rotating disc electrode under potentiostatic conditions it is established that the propagation rate of the precursors is constant within the limits of the diffusion layer boundary. The propagation kinetics follow the expression of Diggle, Despic and Bockris, J. Electrochem. Soc., 116, 1503(1969), if it is assumed that the radii of curvature at the tip of the growing precursors, r, increase proportionally with the height of the precursors, y. The overpotential dependence of the ratio y/r is linear and probably reflects the Kelvin relation. At constant diffusion-layer thickness the moment of the visual appearance of the dendrites coincides with the transition time on the potentiostatic I—t curves. The average height, y, at this moment is equal to the diffusion layer thickness, δ. The average rate of growth of precursors is inversely proportional to δ. An equation for the time of appearance of dendrites which accounts for the effect of diffusion is derived and experimentally tested. The effect of lead ions on the time of appearance is discussed in terms of the kinetic equation. 10 figures, 2 tables.

ENERGY MANAGEMENT AND POLICY

51763 (DOE/TIC—10525) **Department of Energy organization and functions fact book.** (Department of Energy, Washington, DC (USA)). Sep 1977. 45p. P 03/MF A01.

The creation of the Department of Energy, its functions, and the functions of the agencies in it are discussed. The staff and their responsibilities are delineated.

51764 (DOE/TIC—10529) **Handbook of draft standard energy data elements.** (Ideamatics, Inc., Washington, DC (USA)). 11 May 1977. 135p. P 07/MF A01.

The handbook documents the definitions devised from the examination of similar data elements in the ten energy data systems chosen for analysis in the pilot study to evaluate the energy data element standardization problem. It addresses the standardization of data element and terminology definition; data element and terminology codes; nomenclature standards; data element and data item

format description standards; survey questionnaire design standards; conversion factors; units of measure; publication standards; and methodology. The handbook is divided into four sections: (1) Index (alphabetical by data element name, within data systems recommended for usage, and by functional category of data element usage); (2) standard energy data element defintion sheets; (3) bibliographic term analysis; and (4) sample form anlysis.

51765 **Energy technology V: challenges to technology.** Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978). 1085p. (CONF-780222—). The Publisher, 4733 Bethesda Avenue, NW, Washington, DC 20014.

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

A separate abstract was prepared for each of 102 papers presented at the symposium. Eight of the papers were processed earlier. Thirty-two of the papers were DOE-supported and their abstracts will appear in Energy Research Abstracts (ERA); all but one of the abstracts will appear in Energy Abstracts for Policy Analysis (EAPA). (MCW)

ENERGY ANALYSIS AND MODELING

REFER ALSO TO CITATION(S) 50932, 51314, 51785, 51796, 51824, 51856, 51857, 51860, 51866, 51871, 51872

51766 (BNL—26446) **Reference Materials System: materials policy information system.** Bhagat, N.K.; Hoffman, K.C. (Brookhaven National Lab., Upton, NY (USA); Mathtech, Inc., Princeton, NJ (USA)). 1979. Contract EY-76-C-02-0016. 21p. (CONF-790754—1). P 02/MF A01.

From Symposium on renewable resources: a systematic approach; Saltillo, Mexico (31 Jul 1979).

The social and economic development of a nation is dependent on a reliable supply of materials and energy and on the efficient utilization of these resources. Decision making in industry and the formulation of government policies require a comprehensive information base encompassing the technical, economic, and environmental factors involved in the flow of materials through production processes and the overall economy. The Reference Materials System (RMS) is a network description of the flow of materials from resource extraction through refinement, production, and transportation processes to the utilization, maintenance, and recycling operations. The system has been employed for the assessment of material production technologies and for the evaluation of substitution possibilities. The RMS provides a framework for integrating engineering and economic information into a comprehensive systems framework. The network flow diagram is quantified in terms of the mass flow of all renewable and nonrenewable materials on an annual basis through each step of the system. A variety of data elements including capital and labor requirements may be organized in this framework to provide a Materials Policy Data Base. This process description of the materials system may also be coupled with economic policy models of the input—output or econometric variety to ensure proper analysis of the role of materials in the overall economy.

51767 (BNL—26472) **Applications of energy systems analysis to policy and technology studies.** Beller, M. (Brookhaven National Lab., Upton, NY (USA)). Jul 1979. Contract EY-76-C-02-0016. 16p. (CONF-791007—1). P 02/MF A01.

From Energy systems analysis international conference; Dublin, Ireland (9 Oct 1979).

The use of a Reference Energy System, a network representation of all of the technical activities required to supply various forms of energy to end-use activities, is described. Technologies are defined for all operations involving specific fuels including their extraction, refinement, conversion, transport, distribution, and utilization. Each of these activities is represented by a link in the network for which efficiency, environmental impact, and cost coefficients may be specified. The network is quantified for a given year with the level of energy demands and the energy flows through the supply activities that are required to serve those demands. RES are used in an assessment to evaluate new technologies by the techniques of perturbation analysis, and the Brookhaven Energy System Optimization Model includes the same input parameters that are used in the RES. The construction of RES is given. How to use RES for technology and policy assessment is discussed, followed by some example cases. The use of BESOM applied to multi-objective analysis is noted. RES is being used as a starting point for the development of an Energy Emergency Management Informaion System. (MCW)

51768 (BNL—50949) **Evaluation of tecanological data in the DFI and PIES models.** Bhagat, N.; Beller, M.; Hermelee, A.; Wagner, J.; Lamontagne, J. (Brookhaven National Lab., Upton, NY (USA)). Apr 1979. Contract EY-76-C-02-0016. 86p. Dep. NTIS, PC A05/MF A01.

This report evaluates the data used in two of the models available to the Energy Information Administration (EIA). Specifically, the study involves updating, reviewing, and documenting the technological data on primary energy conversion, transportation, distribution and end-use conversion. The major focus is upon data used in the Decision Focus, Inc. (DFI), LEAP model. This is an abbreviated version of the Gulf-Stanford Research, Inc., energy model developed to assess the potential future impacts of synthetic fuels in the US energy system. A parallel effort assesses the data used in the model commonly known as the Project Independence Evaluation System (PIES).

51769 (CONF-7709114—, pp 32p, Paper 3) **Energy utilization and conservation study. Phase II. Results and conservation topics.** 1977.

From 3. ERDA energy management symposium; Knoxville, TN, USA (19 Sep 1977).

Some data on energy conservation and management at five sites of Albuquerque Operations Office are compiled. Annual savings, implementation costs, life-cycle cost paybacks, retrofit modifications, etc., are included for operations at Kansas City, Rocky Flats, Pantex Plant, Mound Laboratory, and Pinellas. (MCW)

51770 (CONS—2858-T1) **Descriptor-variable approach to modeling and optimization of large-scale systems. Final report, March 1976—February 1979.** Stengel, D.N.; Luenberger. D.G.; Larson, R.E.; Cline, T.B. (Systems Control, Inc., Palo Alto, CA (USA)). Feb 1979. Contract ET-78-C-01-2858. 71p. P 04/MF A01.

A new approach to modeling and analysis of systems is presented that exploits the underlying structure of the system. The development of the approach focuses on a new modeling form, called 'descriptor variable' systems, that was first introduced in this research. Key concepts concerning the classification and solution of descriptor-variable systems are identified, and theories are presented for the linear case, the time-invariant linear case, and the nonlinear case. Several standard systems notions are demonstrated to have interesting interpretations when analyzed via descriptor-variable theory. The approach developed also focuses on the optimization of large-scale systems. Descriptor variable models are convenient representations of subsystems in an interconnected network, and optimization of these models via dynamic programming is described. A general procedure for the optimization of large-scale systems, called spatial dynamic programming, is presented where the optimization is spatially decomposed in the way standard dynamic programming temporally decomposes the optimization of dynamical systems. Applications of this approach to large-scale economic markets and power systems are discussed.

51771 (DOE/EIA/8560—2) **Regional demand forecasting and simulation model: user's manual. Task 4, final report.** Parhizgari, A.M. (Synergy, Inc., Washington, DC (USA)). 25 Sep 1978. Contract EM-77-C-01-8560. 381p. P 17/MF A01.

The Department of Energy's Regional Demand Forecasting Model (RDFOR) is an econometric and simulation system designed to estimate annual fuel-sector-region specific consumption of energy for the US. Its purposes are to (1) provide the demand side of the Project Independence Evaluation System (PIES), (2) enhance our empirical insights into the structure of US energy demand, and (3) assist policymakers in their decisions on and formulations of various energy policies and/or scenarios. This report provides a self-contained user's manual for interpreting, utilizing, and implementing RDFOR simulation software packages. Chapters I and II present the theoretical structure and the simulation of RDFOR, respectively. Chapter III describes several potential scenarios which are (or have been) utilized in the RDFOR simulations. Chapter IV presents an overview of the complete software package utilized in simulation. Chapter V provides the detailed explanation and documentation of this package. The last chapter describes step-by-step implementation of the simulation package using the two scenarios detailed in Chapter III. The RDFOR model contains 14 fuels: gasoline, electricity, natural gas, distillate and residual fuels, liquid gases, jet fuel, coal, oil, petroleum products, asphalt, petroleum coke, metallurgical coal, and total fuels, spread over residential, commercial, industrial, and transportation sectors.

51772 (EPRI-EA—1071) **Independent assessment of energy policy models.** Kuh, E.; Wood, D.O. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). May 1979. 273p. P 12/MF A01.

Energy policy models are playing an increasingly important and visible role in supporting both private and public energy policy research and decision making. As importance has increased so too has the need for model review and assessment to assist in establishing model credibility for users and those affected by model-based policy research. Toward this end EPRI has sponsored the M.I.T. Energy Laboratory in one-year project to assess two important energy system models, the Baughman—Joskow Regionalized Electricity Model and the Wharton Annual Energy Model, and to identify and

analyze organizational and procedural issues in the model assessment process.

51773 Symposium papers: energy modeling and net energy analysis. Chicago, IL; Institute of Gas Technology (1978). 804p. (CONF-780843—). The Publisher, 3424 S. State St., Chicago, IL $60.00.

From Conference on net energy analysis and energy modeling; Colorado Springs, CO, USA (21 Aug 1978).

A separate abstract was prepared for 37 of the 42 papers presented at the symposium; five papers were processed earlier. Five tutorial lectures by Joseph G. Ecker, Renesselair Polytechnic Inst., appear in the appendix of this publication, namely: Linear Programming (2); Leontief Economic Models, Network Analysis, and Forecasting. Of the 37 abstracts, all will appear in Energy Abstracts for Policy Analysis (EAPA); nine are DOE-sponsored and will also appear in Energy Research Abstracts (ERA). (MCW)

51774 PILOT Physical Flow Model for assessing long-term energy economic options. Avi-Itzhak, B. (Stanford Univ., CA). pp 85-102 of Symposium papers: energy modeling and net energy analysis. Chicago, IL; Institute of Gas Technology (1978).

From Conference on net energy analysis and energy modeling; Colorado Springs, CO, USA (21 Aug 1978).

The general structure and major features of the PILOT Physical Flow Model and one of its more recent applications are described. The PILOT Physical Flow Model is a large-scale linear program providing a description of the major sectors and overall activities and processes of the economy combined with a detailed energy submodel. The model is essentially a long-term planning tool and can be operated under different assumptions specified by the planner. The model enables the user to measure the impact on the standard of living and on the levels of the major economic activities of the implementation of different policy decisions, in particular those concerning extraction, conversion, and imports of energy forms.

51775 Modeling the National Energy Plan. Greenberg, H.J.; Murphy, F.H. (Energy Information Administration, Washington, DC). pp 103-132 of Symposium papers: energy modeling and net energy analysis. Chicago, IL; Institute of Gas Technology (1978).

From Conference on net energy analysis and energy modeling; Colorado Springs, CO, USA (21 Aug 1978).

This paper describes how the Project Independence Evaluation System (PIES) was used to estimate impacts of the National Energy Plan presented to the Congress and the public April 20, 1977. The presentation includes both the modeling and the modeling process that prevailed; for completeness a summary of the structures and underlying methodologies is also included. The key components considered are: oil and gas price controls, coal conversion and conservation. This paper describes the modeling of the measures in these components and the assumptions made. 10 references.

51776 Issues in net-energy analysis. Fraley, D.W.; McDonald, C.L. (Pacific Northwest Labs., Richland, WA). Contract EX-76-C-06-1830. pp 161-181 of Symposium papers: energy modeling and net energy analysis. Chicago, IL; Institute of Gas Technology (1978).

From Conference on net energy analysis and energy modeling; Colorado Springs, CO, USA (21 Aug 1978).

The paper has two major purposes: provide conclusions about problems involved in applying net-energy analysis; and provide recommendations about the application of net-energy analysis that will lead to an evaluation of energy technologies in a less-ambiguous, more-consistent manner. In pursuit of these purposes, potential issues in the application of net-energy are presented. A number of issue questions are raised which the analyst faces in performing net-energy analysis. To observe which issues may influence the results in actual practice, these questions were asked in the review of twelve selected applications of net-energy analyses. These observations provide the basis for the conclusions and recommendations presented. 21 references.

51777 Net-energy analysis of fossil fuels and a materials-processing application. Melcher, A.G.; Farris, C.B. (Colorado School of Mines Research Inst., Golden). pp 219-244 of Symposium papers: energy modeling and net energy analysis. Chicago, IL; Institute of Gas Technology (1978).

From Conference on net energy analysis and energy modeling; Colorado Springs, CO, USA (21 Aug 1978).

Two studies on net energy are discussed in this paper. The first, net energy analysis: an energy balance study of fossil fuels, developed a methodology and net energy data for twenty trajectories of fossil-fuel-production systems. The systems include resources in the ground and all process steps up to energy delivery to end use. The second study deals with net energy required to produce various materials, fabricate and distribute products from those materials, and recycle the products or materials back into the production system. The methodology and general findings are presented.

51778 Some theoretical considerations of net-energy analysis. Sedlik, B.R. (Teknekron, Inc., Washington, DC). Contract EE-77-X-1-2700. pp 245-261 of Symposium papers: energy modeling and net energy analysis. Chicago, IL; Institute of Gas Technology (1978).

From Conference on net energy analysis and energy modeling; Colorado Springs, CO, USA (21 Aug 1978).

Several methodologies have been developed to perform net-energy analysis. However, considerable confusion still surrounds the purpose and definition of the concept. This paper develops a working definition of net-energy analysis based on fundamental principles. It is ascertained that the critical element of the approach is the determination of the gain function: the function that describes the relationship between the energy produced by and the energy required for an energy-production process. Furthermore, it is determined that the temporal dimension of the gain function is a key item of interest. This results from the two major factors that can impact the gain of an energy production process over time: technological advance and resource depletion. The former is responsible for gain enhancement while the latter contributes to gain deterioration. Evaluation of technological advancement requires a methodology that can account for all the subtle and pervasive energy subsidies that contribute to the successful deployment of the technology. Most of the existing methods of net-energy analysis attempt to accomplish this task. However, only one methodology, energy-circuit analysis, addresses impacts related to the resource-depletion component of the gain function. Nonetheless, the method relies on an energy quality scale that is itself technology-dependent. The major hypothesis of this paper is that a gain function can be determined independent of technology. Such a function based on thermodynamic principles, would be utilized to determine the minimum theoretical work necessary to process an energy resource of any particular quality and spatial distribution. Several forms of the gain function are explored to investigate possible modes of dynamic behavior. In addition, ramifications and potential applications are discussed. 7 references.

51779 Should there be a moratorium on the use of energy macro models. Nehring, R. (Rand Corp., Santa Monica, CA). pp 353-359 of Symposium papers: energy modeling and net energy analysis. Chicago, IL; Institute of Gas Technology (1978).

From Conference on net energy analysis and energy modeling; Colorado Springs, CO, USA (21 Aug 1978).

Should there be a moratorium on the use of energy macro models? The author argues that there should be because recent energy-modeling efforts have incorporated numerous misconceptions and faulty assumptions, the result being misleading guidance to policymakers. We would be better off concentrating our efforts during the next few years on systematic research to reduce current areas of ignorance. The argument is illustrated by a brief review of several recent, well-known efforts to forecast domestic crude oil and natural gas production. Although this is a subject that both modeler and policymaker need to understand well and seemingly have the capability to understand well, none of the forecasts surveyed have more than a negligible probability of being correct, given what we now are beginning to know. All were overly optimistic about the remaining discoverable and recoverable resource base for oil and natural gas and hence about the relevant supply curves. These forecasts helped lead policymakers and the public either to expect too much from some policy proposals or to spend unnecessary effort on insignificant issues. Because this is not the only key area of ignorance, we would be better off concentrating on overcoming our ignorance instead of pretending we know the answers, the author feels.

51780 LLL Energy Policy Model: a convenient policy analysis tool. Sussman, S.S.; Rousseau, W.F. (Lawrence Livermore Lab., Livermore, CA). pp 383-397 of Symposium papers: energy modeling and net energy analysis. Chicago, IL; Institute of Gas Technology (1978).

From Conference on net energy analysis and energy modeling; Colorado Springs, CO, USA (21 Aug 1978).

The model described incorporates considerable technological and regional detail of the energy sector from resource extraction through end use, and typically produces scenarios for a 50-year time horizon. The capabilities of the model and the methods used to construct it represent a considerable advance of the state-of-the-art. Analysis of both free-market scenarios and scenarios incorporating government regulations (e.g., price and volume constraints) and environmental limitations on energy growth can be performed. A new computer language was devised and implemented which permits the analyst to easily construct and modify energy networks of varying degrees of regional and technical detail. Thus, while the LLL current multi-region model computes 30,000 supply-demand balances in each run, the language permits the user to conveniently make model changes for the investigation of alternative policy scenarios, as well as to easily construct more aggregated models for less-detailed analyses. Representative results demonstrating these capabilities are presented.

51781 What's really new about policy modeling: an assessment of where we are today. House, P. (Department of Energy, Washington, DC). pp 447-470 of Symposium papers: energy modeling and net energy analysis. Chicago, IL; Institute of Gas Technology (1978).

From Conference on net energy analysis and energy modeling; Colorado Springs, CO, USA (21 Aug 1978).

It is the contention of this paper that the research in modeling and its allied fields is far advanced indeed; further, that the frontiers suggested by this research are of great use to those who use these models for theory-building analysis and the like. Looking across the full spectrum of model use, there are a very large number of models in use or development. Depending upon intended use, almost all of these models are proper applications of the art. However, it is further contended that once the discussion of the use of models is narrowed - by requiring that only those which are able to be used for policy purposes be considered - the rules for determining what is a proper model change. This change consists of a tendency to choose models made up of those that are more fully tested and contain algorithms that have greater degrees of consensus among those who are considered the cognoscente in the subject area being modeled. Given this hypothesis, it will be years before the models available today for say, research purposes, become reasonably acceptable (if ever) for policy use. In short, the potential for advances in the state-of-the-art of policy models resides largely with models in existence today. Consequently, by reviewing these models one learns their weaknesses and limitations. Further, by assessing the potential for overcoming their shortcomings in the near future, it is possible to realistically forecast the probable advances to policy models in the future. The author demonstrates his hypotheses by discussing theory and model structure, data, validation, and use. In an appendix, the Strategic Environmental Assessment System (SEAS) Model is described. 36 references.

51782 Survey of energy modelling. Hoffman, K.C. (Brookhaven National Lab., Upton, NY). *Scientia (Milan);* **6**: No. 1-2, 1-15(1977).

The scope of energy modeling has expanded significantly in the past few years as energy has been recognized as a vital component in the social and economic development of nations. As such, it must be considered explicitly in the formulation of regional, national, and international policy. The energy models described are employed to study interfuel substitution and technological change. They involve energy models coupled with economic and environmental models of national and international scope. The methodologies employed and the policy applications of the various models are discussed. Strategic planning is a responsibility of both industry and government and must deal with the complexities of the energy system embedded in the economy and environment. The systems approach can contribute to more rational strategic planning in the energy sector by providing a conceptual framework for discussion and a basis for quantitative analysis. Energy R and D policy is an important component of strategic planning and a comprehensive systems methodology has been developed and applied to this policy area. The Reference Energy System and Energy System Optimization Model were designed for application to strategic planning and have been used in the assessment of new energy technologies. These models and their application are discussed in detail. Extensions of the methodology involving coupling of the energy system model to an economic model are discussed.

ECONOMICS AND SOCIOLOGY

REFER ALSO TO CITATION(S) 51770, 51774, 51780, 51789, 51794, 51803, 51812, 51825, 51832, 51852, 51870

51783 (CONF-7709114—, pp 18p, Paper 4) **Life-cycle costing: emphasizing energy conservation.** 1977.

From 3. ERDA energy management symposium; Knoxville, TN, USA (19 Sep 1977).

Life-cycle costing is a method or tool to use for investment decision making or more simply stated - an analysis of tradeoffs between putting more capital money in initially to save annual operating dollars later. Topics covered include: objectives and limitations; LCC applied (design process); LCC analysis components; study parameters; measurement statistics; and methodology. (MCW)

51784 (DOE/ET—2720-1) **ND-REAP/DOE cooperative project: final report.** (North Dakota Regional Environmental Assessment Program, Bismarck (USA)). Jan 1979. Contract EF-77-G-01-2720. 67p. P 04/MF A01.

The impacts of energy-related developments in North Dakota are having profound effects on the state. Among the most significant of these effects are those on the state's economy and its population. Knowledge of the total environmental effects of development is a necessary prerequisite for effective planning and decision making. This final report addresses the conceptual design and functional evolution of the Regional Environmental Assessment Program, the results of the REAP/DOE Cooperative Effort, as well as evolution of the REAP/DOE effort and recommendations for future directions. The Economic Demographic (E-D) Model was developed to give North Dakota decision makers a tool with which to evaluate the impacts of coal development. It projects social, economic, and characteristics of North Dakota. Refinements and expansion of the model are discussed in Section 1. Section 2 provides an evaluation of the model as applied to other states. Section 3 identifies and evaluates the use of REAP data and capabilities to date. The REAP Resources Reference System R^3S was developed to provide access to information systems and to past research and present studies about aspects of North Dakota. It is a computer-based library reference system. Its status and expansion potential is covered in Section 4. Section 5 makes recommendations for future efforts.

51785 Energy and economic growth: a conceptual framework. Sweeney, J.L. (Stanford Univ., CA). pp 59-83 of Symposium papers: energy modeling and net energy analysis. Chicago, IL; Institute of Gas Technology (1978).

From Conference on net energy analysis and energy modeling; Colorado Springs, CO, USA (21 Aug 1978).

The relationships between energy and the economy are complex and multifaceted. Sudden changes in energy price or availability can lead to structural and aggregate unemployment, to sharp increases in inflation, and to major changes in the distribution of wealth, both among nations and within a given country. In the longer run, when transitional impacts subside and after compensating monetary and fiscal policies are implemented, changes in the price or availability of energy may influence the long-run growth prospects of a nation. The purpose of this paper is to provide a simple conceptual framework within which the long-run impacts of energy on economic growth can be considered. Within this framework the question is asked: What will be the impact on aggregate output, consumption, and welfare of changes in the availability or price of energy? In this long-run analysis it will be assumed that the economy always maintains full employment of all factors of production. Differences amongst the energy carriers - coal, oil, natural gas - will be ignored in order to facilitate the conceptual discussion, although the extension to consider different fuels is possible.

ENVIRONMENT, HEALTH, AND SAFETY

REFER ALSO TO CITATION(S) 51060, 51424, 51784, 51789, 51801, 52134, 52145, 52147, 52189, 52190, 52239

51786 (DOE/IR—0052) **Radiation protection enrollments and degrees, 1978: enrollments, Fall 1978, degrees granted, July 1966—June 1978.** (Department of Energy, Washington, DC (USA)). Aug 1979. 61p. P 04/MF A01.

This report presents the results of the eighth annual survey of Radiation Protection Enrollments and Degrees. Each year the survey is sent to institutions offering degrees in radiation protection and in other closely related fields (health physics, radiation health, radiological physics, radiobiology, and similar programs) whose graduates would be prepared to conduct, coordinate, direct, or plan a program for the evaluation and control of radiation hazards in various settings. Data are presented on enrollments and degrees, placement of graduates, women and minorities, foreign nationals, and regional distribution. 2 figures, 10 tables. (RWR)

51787 Impact of Best Available Control Technology. Yeager, K.E. (Electric Power Research Inst., Palo Alto, CA). pp 132-141 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Emerging trends in pollution control regulations will have major impact on energy production from both a policy and research standpoint. Foremost among these trends is the shift from quantitatively supported national health and welfare based ambient air quality criteria to subjective judgments supporting a control technology forcing strategy, for example, Best Available Control Technology (BACT), as the primary regulatory mechanism. Even though an unencumbered advanced technology may have both economic and environmental advantage over existing approaches, the additional technical and cost penalties associated with maximizing emission control under the BACT concept may delay or prevent its commercialization. Practical resolution of the dilemma lies not in choosing between environmental protection and energy self-sufficiency or substituting an uncontrolled economic experiment for an environmental one. Rather it lies in demanding accountability in environmental protection. Of immediate impact is the proposed revisions to the New Source Performance Standards. Impacts dealing with the SO_2, particulate, NO/sub x/, potentially hazardous substances, fluidized combustion are discussed. The economic implications of alter-

native environmental policies are also significant. Experiences with flue gas desulfurization are also examined. It is concluded that any revision of New Source Performance Standards for utility application should be limited to levels that have been adequately demonstrated considering extended commercial operation (1 year) on a variety of utility sources which represent the range of boiler design and fuel conditions in use by the industry. (MCW)

NATURAL RESOURCES

REFER ALSO TO CITATION(S) 51127, 51128, 51766

RESEARCH, DEVELOPMENT, DEMONSTRATION, AND COMMERCIALIZATION

REFER ALSO TO CITATION(S) 50998, 51210, 51221, 51222, 51767, 51791, 51826

NUCLEAR ENERGY

REFER ALSO TO CITATION(S) 51154, 51157, 51158, 51159, 51177, 51178, 51179, 51431, 51434, 51435, 51538, 51635, 51636, 51786, 51817, 51820

51788 (DOE/IR—0053) **Nuclear engineering enrollment and degrees, 1978: enrollments, Fall 1978, degrees granted, July 1966—June 1978.** (Department of Energy, Washington, DC (USA)). Aug 1979. 69p. P 04/MF A01.

This report presents the results of the eighth annual survey of Nuclear Engineering Enrollments and Degrees. Each year the survey is sent to institutions offering degrees in nuclear engineering or other engineering disciplines with nuclear engineering options. Although the number of institutions included may vary from year to year, historical information about degrees granted since July 1966 has been collected for all institutions. Over the past few years there have been significant perturbations in the supply of new engineers with nuclear expertise caused by many factors, such as the general decline in engineering enrollments, concern about involvement in nuclear activities, and uncertainty about a nuclear power future. This series of nuclear engineering enrollment and degree surveys has charted the changes in the supply of professional nuclear personnel and assisted planners and educators alike in preparing to provide for this needed energy resource. Data are presented on enrollments and degrees, placement of graduates, women and minorities, foreign nationals, and regional distribution. 1 figure, 11 tables. (RWR)

51789 **Nuclear energy: salvaging the atomic age.** Weinberg, A.M. *Wilson Q.*; 3: No. 3, 88-112(Sum 1979).

The history of atomic power is reviewed from the first chain reaction in Chicago in 1942 to the worst-to-date accident at the Three Mile Island power plant in March, 1979. While media coverage during the Three Mile Island incident made the public aware of some reactor hardware and radiation hazards, Weinberg suggests that an acceptable nuclear future should have six characteristics: increased physical isolation of reactors, further technical improvements, separation of generation and distribution, professionalization of the nuclear cadre, heightened security, and public education about the hazards of radiation. Weinberg feels the question of low-level radiation effects to be critical to public acceptance of nuclear energy. Since the effects (if any) are so rarely seen because exposures are so small, the issue may be beyond the ability of science to decipher. Weinberg again explains his reference to nuclear energy as a Faustian Bargain: "...nuclear energy, that miraculous and quite unsuspected source of energy, demands an unprecedented degree of expertise, attention to detail, and social stability. In return, man has, in the breeder reactor, an inexhaustible energy source."

51790 **Structure of the energy markets: a report of TVA's antitrust investigation of the coal and uranium industries, 1979 update.** Sanger, H.S. Jr.; Mason, W.E. Knoxville, TN; Tennessee Valley Authority (1979). 198p.

The recent merger activity listed in the report intensifies our concern for America's energy markets because those markets are already unduly concentrated. It is generally recognized that effective competition may be endangered or even prevented when the four largest firms in a market control over half the industry's production. Three of the Nation's major regional coal markets are that concentrated - including the Midwest market from which TVA buys 70 percent of its coal. The top four firms in the Midwest market now control 56 percent of production. These important regional coal markets - and the other domestic markets to a lesser extent - are not only dangerously concentrated, but are also dominated by companies with other energy interests. The same is true of the uranium market. It is highly concentrated and is dominated by nine of the Nation's largest oil companies, eight of whom also have major coal interests. This uncompetitive structure of the coal and uranium markets can adversely affect both fuel prices and supplies. Because the fuel markets are oligopolies, and since oligopolists price their goods above competitive market price, coal and uranium prices are likely to be higher than necessary. Worse, since the same group of energy companies which dominate the coal markets also dominate the uranium market, consumers are even deprived of the potential benefits of price and supply competition between those two competing fuels. The prices of coal and uranium have increased ennormously in recent years. Coal now costs over four times what it cost in 1970. Portions of this sharp increase in fuel prices have been explained by some as the expected effects of the various forces listed. However, there is a basis for believing that a portion of the price increases may be accounted for as the effects of the uncompetitive structure of the coal and uranium markets. (LTN)

TRANSPORT AND STORAGE

REFER ALSO TO CITATION(S) 51209, 51422, 51753, 51888, 51889

51791 (DOE/ET—0109(DRAFT)) **Multi-year plan for Thermal and Mechanical Energy Storage program.** (Department of Energy, Washington, DC (USA). Div. of Energy Storage Systems). Jun 1979. 80p. P 05/MF A01.

The Thermal and Mechanical Energy Storage Program of the Energy Storage Systems Division (STOR) of the Department of Energy (DOE) develops reliable, efficient, inexpensive energy storage technologies to support other DOE end-use divisions in their substitution and energy-savings missions. In addition to thermal and mechanical technology development, this plan describes the Technical and Economic Analysis subprogram which supports both the Thermal and Mechanical Storage Program and the Electrochemical (Battery) Storage Program. Thermal and mechanical storage technologies are most advantageous in applications such as solar and conventional heating and cooling, vehicle shaft power, industrial heating and feedstock substitutes, solar and wind shaft power, and load-shifting to coal, nuclear, or solar thermal electric plants. The DOE end-use organizations that will benefit from development of thermal and mechanical storage technologies are the organizations that have prime responsibility for satisfying the above applications. These are: Central Solar Technology (CST), Distributed Solar Technology (DST), Solar Applications (SA), Transportation Programs (TP), Buildings and Community Systems (BCS), Industrial Energy Conservation (INDUS), and Resource Applications (RA--power marketing functions). Technology development for some of these applications also helps to satisfy missions within the divisions of Nuclear Power Development (NPD), Fossil Fuel Processing (FFP), Magnetic Fusion Energy (MFE), and Electric Energy Systems (EES).

WASTE HEAT UTILIZATION

REFER ALSO TO CITATION(S) 51283, 51284, 51417, 51421, 51541, 51820, 51827, 51839, 51880, 51881, 51882, 51883

51792 (TID—28853) **Commercialization strategy report for cogeneration.** (Department of Energy, Washington, DC (USA)). 1978. 75p. P 04/MF A01.

The commercial readiness assessment for cogeneration is discussed. Technical, market/economic, environmental, and institutional readiness aspects are covered. Benefits analysis is presented. The commercialization strategy for cogeneration is covered by discussing commercialization profile and recommended commercialization approach. The principal technologies currently available for cogeneration include extraction steam turbine-generator, gas turbine system with waste heat boiler; and diesel with waste heat recovery.

CONSERVATION

REFER ALSO TO CITATION(S) 51783, 51822, 51845, 51846, 51847, 51848, 51856, 51857, 51858, 51860, 51861, 51862, 51863, 51865, 51868, 51871, 51875, 52134

51793 (CONF-7709114—) **3rd ERDA energy management symposium.** (Energy Research and Development Administration, Oak Ridge, TN (USA). Oak Ridge Operations Office). 1977. 228p. P 11/MF A01.

From 3. ERDA energy management symposium; Knoxville, TN, USA (19 Sep 1977).

A separate abstract was prepared for each of eleven collected papers that were presented at the symposium. No proceedings were published. (MCW)

51794 (CONF-7709114—, pp 11p, Paper 1) **Energy management project qualification.** 1977.
From 3. ERDA energy management symposium; Knoxville, TN, USA (19 Sep 1977).

Various economic criteria (inflation, discount rate, rates of return, differential cost escalation, base-period costs, computation methods, etc.) are charted as guidelines to energy management project qualification.

51795 (CONF-7709114—, pp 11p, Paper 5) **Energy management in ERDA facilities.** 1977.
From 3. ERDA energy management symposium; Knoxville, TN, USA (19 Sep 1977).

Among the Big 26 Federal agencies, ERDA ranks first in energy intensity per square foot, second in total energy consumption, and fourteenth in its conservation record. This publication presents ERDA energy management records; some consumption records for specific years; energy conservation goals and its programs; in-house energy management program (funding history FY 1976 to 1979); proposed ERDA in-house energy management program; and FY 1979 in-house energy management plant and capital equipment budget.

51796 (CONF-7709114—, pp 12p, Paper 7) **Energy conservation in TVA facilities.** 1977.
From 3. ERDA energy management symposium; Knoxville, TN, USA (19 Sep 1977).

Initially, TVA assessed fuel consumption per square foot for its facilities (expressed graphically). This data identified high energy use facilities, related consumption to facility use, allowed for comparison of present consumption rates with general guidelines available (from industry), and permitted identification of preliminary targets for fuel use reduction. Use of thermometers and hygrometers permitted sun and wind loading impacts to be assessed. An initial energy consumption inventory was made of each facility to define high energy consumption equipment, lighting levels currently in use in the facility, predominant facility uses, facility conditions as they related to energy loss, HVAC operating patterns, operations within the facility where environmental conditions were critical to the operation, and those operations requiring controlled water temperatures or other special conditions significantly impacted by changes in the energy consumption within the building. The inventory also included an onsite appraisal of potential opportunities for energy conservation within this specific facility. An action plan included first, apply energy conservation measures common to all facilities; secondly, apply specific actions at each facility; and thirdly, develop a 10-year plan providing for an energy audit of all facilities. With this assessment will be an evaluation to determine where solar assists can be performed in conjunction with the modification directly related to energy conservation. (MCW)

51797 (DOE/S—0005) **Energy management in the Federal government. Annual report, to the President of the United States, fiscal year 1977.** (Federal Energy Management Program, Washington, DC (USA)). Aug 1978. 38p. P 03/MF A01.
This report summarizes the Federal government accomplishments in energy conservation since FY 1975. The Federal energy conservation effort is monitored by the Department of Energy through the Federal Energy Management Program and involves the contribution of 66 Federal agencies. This report is based on the best available data obtained from agency annual reports submitted to the Department of Energy in accordance with the reporting requirements of Section 2 of the Executive Order, from agency quarterly energy use reports, and from studies and analyses prepared by DOE. The individual agency annual reports contain program information from which the highlights presented in this document have been extracted. Following an introductory chapter, the Federal energy picture; the Federal Energy Management Program (energy management in general operations, energy management in buildings, related programs); program highlights; and future activities are presented.

51798 (DOE/TIC—10178) **Issues and lessons learned in planning and implementing Energy Extension Service small business programs: some case examples.** (Department of Energy, Washington, DC (USA)). 23 Mar 1979. 99p. P 05/MF A01.
As part of an effort to lower energy-consumption levels among individuals and small establishments that use energy, the Energy Extension Service, operating in ten pilot states, has implemtned programs which focus on the particular needs of small businesses. In Alabama, Auburn University provides information and analyses to test the feasibility of using alternative fuels for small businesses. In Connecticut, the Department of Commerce provides audits to businesses throughout the state. In Michigan, the Department of Commerce, through two contractors, provides seminars to one tenth of the small businesses in southeastern Michigan. In New Mexico, the small-business program provides demonstration audits of small businesses using alternative energy sources. In Pennsylvania, EES, in connection with Pennsylvania State Univ., provides technical assistance to small businesses throughout the state. In Tennessee, the program provides audits, seminars, and counseling services to small businesses in three of that state's counties. In Texas, the Texas A and M College of Engineering operates an information retrieval system for small manufacturers through a bi-monthly bulletin. In Seattle, Washington, the small-business program provides audits to "Mom and Pop" type businesses in two of that city's neighborhoods. In Wisconsin, the Univ. of Wisconsin provides seminars and audits to hospitality industry businesses. In Wyoming, the small-business program provides seminars to firms in the building industry. This case study was prepared in order to describe these programs in further detail, and is presented in two sections. The first section consists of papers on topics of particular concern for persons operating or planning a small-business program. The second section provides a summary description of the small-business programs operating in each of the ten pilot states.

51799 **State supplemental energy conservation plan (Second year supplemantal plan).** Baton Rouge, LA; Department of Natural Resources (1978). 63p. (NP—23812).
The Louisiana Supplemental State Energy Conservation Plan prepared to meet DOE guidelines for participation in the energy conservation legislation under U.S. Public Law 94-385 is presented. It includes the Supplemental Plan, as defined by DOE, and assists in exceeding the minimum goal of a 5% reduction in the projected 1980 Louisiana energy consumption. The overview provides a background concerning the Louisiana energy profile, the basic philosophy in the development and implementation of the State Plan, and a brief discussion of the total plan.

SUPPLY, DEMAND, AND FORECASTING

REFER ALSO TO CITATION(S) 51036, 51766, 51771, 51773, 51804, 51832, 51868

51800 **State of Energy, 1978.** Fawcett, S.L. (Battelle Memorial Inst., Columbus, OH). pp 1-13 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).
From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).
In his keynote address, Dr. Fawcett focuses on economics and technology, describing the energy situation. He first reviews US energy consumption from 1950 to 1975, to conclude that since the 1973 oil embargo, there has been no serious effort to decrease dependence on oil or gas. The amount of imported oil keeps increasing each year; attempts at conservation are ineffective; and there is not a workable energy policy. There is no cheap way out of the dilemma and no assurance that the US can develop sufficient new domestic resources of oil and gas. There is a lack of public concern, and far-seeing political intervention is impossible, especially when the public is angry about increasing costs and local shortages, Dr. Fawcett goes on. He then outlines the commonly known national objectives - decrease dependence on foreign sources of energy; improve quality of life with enough energy supplies; energy at reasonable costs; and sufficient supplies of environmentally acceptable energy sources. The consequences of adopting these objectives are discussed. The author lists the 4 potential ways of achieving these objectives: we must increase resources and recovery of domestic oil and gas; we must substitute coal, nuclear energy, and possible biomass, for gas and oil when possible; we must conserve energy; and we must produce synthetic gas and oil. After examining the situation, the author emphasizes that each citizen must be concerned, dedicated, and understanding of the situation. (MCW)

POLICY, LEGISLATION, AND REGULATION

REFER ALSO TO CITATION(S) 50960, 51228, 51229, 51767, 51772, 51775, 51779, 51780, 51781, 51799, 51800, 51808, 51810, 51811, 51814, 51825

51801 (COO—4750-1) **Development of a management system for implementing the NEPA process in the Department of Energy. Technical progress report, March 1, 1978—February 28, 1979.** Rolan, R.G. (Dalton-Dalton-Little-Newport, Cleveland, OH (USA)). Apr 1979. Contract EP-78-C-02-4750. 227p. P 11/MF A01.
DOE'S numerous difficulties in responding to the National Environmental Policy Act have sometimes resulted in costly pro-

gram delays. The Assistant Secretary for Environment commissioned this three-year project to develop a comprehensive approach to managing NEPA compliance agency-wide. The first year's effort resulted in the conceptual design described in this report. The approach used in the NEPA Management System (NMS) project included: analysis of DOE's basic functions to achieve its mission and their associated environmental requirements; analysis of existing DOE mechanisms for meeting these environmental requirements; development of potential approaches for improving the Department's response to NEPA. The issues and potential solutions presented are based on review and analysis of scores of DOE management guidance documents and interviews with hundreds of DOE personnel, both at headquarters and in the field. A six-part Conceptual Framework of the NMS was developed to organize the analysis and present its conclusions. Potentially responsive approaches to improve DOE's NEPA response include: early consideration of the environment in departmental policy making and regulations development; early, detailed planning for NEPA document preparation and review; integration of NEPA compliance activities with DOE procurement processes; institution of post-EIS mitigation and monitoring procedures; development of comprehensive guidance for all aspects of NEPA compliance. Conceptual approaches to solving each of these problems are presented as a basis for more detailed work in the second year.

51802 (NP—23789) **Energy costs in Texas. Final report.** (Texas Senate Subcommittee on Consumer Affairs, Austin (USA)). Dec 1976. 15p. C .

After substantial research, a series of reports was prepared on the different proposals brought out at the hearings and the staff collected them into an information package entitled Options for Reducing Texas Utility Consumers Energy Bills. This consisted of detailed descriptions, including legal aspects, revenue estimates, and impact on customers' utility bills, of all major proposals to reduce energy costs in Texas. The staff attempted to measure the impact of such proposals as peak load pricing, elimination of the sales tax on utility bills, flat rates, alteration of the severance tax structure, and others. Estimates of possible consumer savings ranged from 2 to 4% for tax revision to more than 20% through rate structure revision. Reports on current energy conservation efforts in Texas, federal and State energy programs and funding, and utility customer class data were also attached. The package concluded with a chart summarizing the effects of all major proposals on consumers' bills and on State revenues and a description of three possible combinations of the different proposals which could be enacted by the Legislature. These offer potential reductions in customers' bills of as much as 40%. The report was submitted to the Subcommittee members for their review at the October 1, 1976 meeting.

51803 (UCRL—52754) **Energy system in the Far West: impacts of the National Energy Act of 1978.** Hammond, B.; Bradshaw, T.; Dorn, D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Apr 1979. Contract W-7405-ENG-48. 46p. P 03/MF A01.

This report provides information on the impact of the National Energy Act of 1978 (NEA) on state energy systems in Federal Region IX (Arizona, California, Hawaii, and Nevada). It includes data on the demographic and economic character of the region; a state-by-state analysis of the way the act will affect the major firms and government regulatory agencies involved in the production, distribution, and exchange of energy; an overview of the impact of the NEA on each energy industry in the region; and a discussion of the act's impact on interstate linkages and the reliability of energy supplies. The basic conclusion is that the NEA wll serve to encourage actions already being taken by many of the utilities, but that it will not effect major changes in existing patterns of energy use.

51804 **Luncheon address.** Myers, D.D. (Dept. of Energy, Washington, DC). pp 97-102 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

In his luncheon address, Dale Myers presents DOE's current view of the nation's energy problem; restates the principles on which our energy policy is based; describes the major thrusts of our evolving National Energy Plan; and indicates some of the major technologies we look to. He concludes that there is no single road to energy sufficiency. The concern is that we must find technologies that will be reliable, environmentally and institutionally acceptable, and price-competitive. (MCW)

51805 **Legislative perspective on energy.** McCormack, M. (US House of Representatives, Washington, DC). pp 1052-1063 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Congressman McCormack reviews pieces of energy legislation that have been introduced and some that have not been introduced at the time of this conference. Those introduced include the strip mining law, the Clean Air Act amendments, and the nuclear export legislation that was awaiting the President's signature. Three bills had not been presented to the Congress by the Administration, including bills on nuclear licensing, storage of irradiated nuclear fuel, and management and ultimate disposal of nuclear wastes. The final piece of legislation the author comments on is the authorization bill for the Department of Energy. He then showed some graphs correlating energy consumption, employment, and GNP in the US. A realistic projection of the year 2000 indicates that it may be necessary to increase domestic energy production to the equivalent of about 60 million barrels of oil per day in order to maintain economic stability and prevent a sharp decline in the standard of living for the American people. He sees only two flexible and significant sources of domestic energy; natural gas and nuclear power. However, there is not enough fuel for 400 conventional nuclear power plants unless fuel is recycled in the 1980s and the nuclear breeder program is committed in the early 1990s, he says. Goals for the 21st century are not possible unless an intelligent and responsible energy policy is established in the balance of the 20th century, he concludes. (MCW)

51806 (NP—23790) **[Interim hearings and studies on energy resources problems and proposed legislation].** (Texas Committee on Energy Resources (House of Representatives), Austin (USA)). [nd]. 44p. NTIS, PC A03/MF A01.

FOSSIL FUELS

REFER ALSO TO CITATION(S) 51036, 51435, 52145

COAL

REFER ALSO TO CITATION(S) 50932, 50939, 50940, 50942, 50949, 50951, 50953, 50960, 50965, 50998, 50999, 51018, 51060, 51075, 51080, 51097, 51790, 52086

51807 **Incentives and requirements for gasification-based power systems.** Holt, N.A. (Electric Power Research Inst., Palo Alto, CA). pp 588-605 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

The main incentives for the use of gasification-based power systems over other coal-based generating systems such as direct coal firing with stack-gas scrubbing are: markedly reduced emissions; better resource utilization (coal, water, land); and competitive capital cost and cost of power. The results of a series of economic studies conducted by Fluor Corp. for EPRI indicate that the capital cost of Integrated-Gasification Combined-Cycle power plants are 700 to 850 $/kW in mid 1976 dollars with heat rates in the range 8400 to 9000 Btu/kWh. Of all the potential uses of coal gasification in power systems, this appears the most attractive. Coal gasification uses in power systems considered were: clean fuel gas for combustion turbine combined cycle, regenerative or fuel-cell systems; clean fuel gas for direct firing in steam boilers; synthesis gas as a source of clean liquid fuels for intermediate- and peaking -load duties on gas turbines and fuel cells; and as a source of hydrogen for coal liquefaction and regenerative stack-gas-scrubbing processes. The desirable gasifier characteristics for integration in gasification combined-cycle systems are simplicity, feedstock flexibility, minimum downstream gas processing, and compatibility with power-generation requirements. The status of the gasifier technology is reviewed. (MCW)

51808 **Converson to coal.** Albany, NY; New York State Legislative Commission on Energy Systems (1978). 160p. (CONF-771122—).

From Conversion to coal conference; Albany, NY, USA (1 Nov 1977).

In June 1974, the Federal Government enacted the Energy Supply and Environmental Coordination Act, which, among other things, set up a procedure and criteria under which the Department of Energy can order the owner of a major fuel burning installation to stop burning oil, or natural gas and, if he wants to keep operating, start burning something else. Congress expected that something else would usually be coal. Last summer DOE (actually it was still the Federal Energy Administration then) issued just such orders, affecting three plants, to Long Island Lighting. LILCO's response, and the response of Long Islanders who live near the plants generally was to say that converting the boilers would be unjustifiably costly, that the company would have to build expensive new coal-handling and transportation facilities as well, and that handling and burning coal at those plants, in suburban neighborhoods, would be intolerably dirty and noisy. Several Federal and State energy experts, as well as industry representatives were asked to answer some of the questions this and the plans for increased use of coal in President Carter's energy program raise. We asked about air quality and health

effects, scrubbers, capital costs of converting oil-fired boilers and building new coal plants, effects on utility rates, new ways of burning coal more cleanly, ways of pre-treating coal such as coal gasification and liquefaction, coal availability and transportation, and other alternatives to oil, such as refuse-derived-fuels. The New York State Legislative Commission hearings are recorded here. (LTN)

PETROLEUM

REFER ALSO TO CITATION(S) 51060, 51101, 51115, 51219, 51779

51809 (DOE/TIC—10531) **Economic impact evaluation of a proposal regarding allocation of increased costs to gasoline.** (Federal Energy Administration, Washington, DC (USA)). Mar 1977. 25p. P 02/MF A01.

The amount of gasoline which domestic refiners are willing to supply is a function of the price which refiners receive for gasoline. The higher the price, the more gasoline refiners are willing to produce. The more stringent price controls on gasoline resulting from the decontrol of other refined products tend to induce domestic refiners to produce less gasoline, which could lead to greater dependence on imported gasoline and/or gasoline shortages. FEA is now proposing to allow refiners to allocate to gasoline a greater than volumetrically proportional amount of increased costs. Four alternative methods and their economic impact are examined. (MCW)

51810 **Oil price decontrol debate: the President's plan.** Schultze, C.L. *Challenge;* **22**: No. 3, 28-34(Jul 1979).

The President's decision to decontrol domestic oil prices and end the subsidization of imports will stimulate domestic oil production and help to finance the transition to alternative energy sources. The three-part program allows domestic oil prices to reach world levels by October, 1981 and imposes a windfall profits tax. Decontrol benefits will include a lower level of imports, a stronger international economy, an end to the entitlements system, and a minimization of disruptions. The revenues from taxing windfall profits will also be used to protect low-income families from the impact of higher prices and to support energy-efficient mass-transit systems.

51811 **Oil price decontrol debate: the case for decontrol.** Adelman, M.A. (Massachusetts Inst. of Technology, Cambridge). *Challenge;* **22**: No. 3, 38-40(Jul 1979).

Decontrol of oil prices would eliminate the subsidies that encourage excessive consumption of imported fuel while discouraging exploration for new oil. Higher prices will put unprofitable and abandoned wells back into production, encourage enhanced oil recovery projects, and promote investment in new discovery. Although oil industry's claim that profits are needed for exploration is called fallacious, the proposed tax on excess profits is viewed as an excise, not an income, tax and a deterrent to investment. In place of the present complicated proposal for shifting profits to alternative energy and mass transit projects, the author suggests a simple decontrol of oil prices and a direct subsidy to low-income groups.

51812 **Oil price decontrol debate: what is the energy crisis.** Davidson, P. (Rutgers Univ., New Brunswick, NJ). *Challenge;* **22**: No. 3, 41-46(Jul 1979).

An economist sees the President's oil price decontrol program as a tilt toward the oil industry in the struggle with consumers over income shares. Current supply conditions keep up with inflation so that higher prices will redistribute income and wealth from consumers to producers without increasing supplies. The author recommends an active, all-out economic war with the Persian Gulf States to avoid the permanent drain on consumers that will result from President Carter's passive approach of oil deregulation, which will only stimulate inflation and income transfer. Conservation policies can be based on lowering demand by increasing prices or by shifting the demand curve so that consumers use less oil regardless of price. The latter can be accomplished by breaking the oil cartel or by sharing in the monopoly rents through taxes and the elimination of tax credits. The revenues generated could be used to generate oil substitutes.

51813 **Optimal drawdown patterns for strategic petroleum reserves.** Kuenne, R.E.; Blankenship, J.W.; McCoy, P.F. (Princeton Univ., New Jersey). *Energy Econ.;* **1**: No. 1, 3-13(Jan 1979).

An optimization model is described for determining optimal drawdown trajectories for strategic petroleum reserves during an embargo. Development of the model includes the derivation of a GNP response function which relates GNP (used as a measure of social welfare) and crude oil supply reductions. Two alternative forms of this function are used with the model. Simple algorithms are presented which give rapid solutions for the model. The pattern is one of saving some of the reserve to protect against a possible second embargo occurring beforee refill, and of allocating the remainder during the first embargo subperiod so as to equalize monthly marginal benefits. 6 references.

51814 **Dept. of Energy/industry relationships and the implementation plan for enhanced oil recovery.** Ham, J.D. (Dept. of Energy, Washington, DC). pp 877-881 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

All domestic sources of energy must be developed to create a broad range of energy choices for the future. During this period of development, petroleum and coal will be the key components of the Nation's energy supply for the remainder of this century. The efficient production and utilization of our fossil energy reserves are therefore crucial. In the short term, enhanced oil recovery is one of the few methods available for substantial new domestic energy contributions. Approximately 68% of the original oil-in-place is unrecovered after primary and secondary production, leaving a target resource of about 300 billion barrels, much of which is physically unrecoverable. DOE's goals for enhanced oil recovery are summarized. These goals require developing a sense of urgency between industrial and governmental participants. Furthermore, a stable economic policy with respect to long term oil pricing is essential to stimulate production in this high-risk area. Enhanced recovery must be accomplished in an environmentally acceptable manner. Scope of the technology implementation plan and commercialization requirements and strategy are discussed. (MCW)

NATURAL GAS

REFER ALSO TO CITATION(S) 51060, 51779, 51802, 51806

OIL SHALES AND TAR SANDS

REFER ALSO TO CITATION(S) 51060, 51126, 51127, 51128

ELECTRIC POWER

REFER ALSO TO CITATION(S) 51223, 51224, 51225, 51383, 51422, 51424, 51753, 51770, 51772, 51829

51815 (CONF-7809138—) **Electric utilities in Illinois.** (Illinois Univ., Chicago (USA). Energy Resources Center; Department of Energy, Washington, DC (USA); Illinois Energy Resources Commission, Springfield (USA); Illinois Inst. of Natural Resources, Springfield (USA)). 1978. Contract EW-78-C-02-5105. 247p. P 11/MF A01.

From 6. annual Illinois energy conference on electric utilities; Chicago, IL, USA (27 Sep 1978).

Although the conference dealt specifically with concerns of the electric utilities in Illinois, the issues were dealt with in the national context as well. A separate abstract was prepared for each of the 5 sections of this proceeding. A total of 25 papers were presented. Section titles are: Forecasting, Planning and Siting, Reliability, Rates and Financing, and Future Developments.

51816 (CONF-7809138—, pp 9-58) **Forecasting.** (Economic Sciences Corp., Berkeley, CA). 1978.

From 6. annual Illinois energy conference on electric utilities; Chicago, IL, USA (27 Sep 1978).

Five papers were presented at the session on forecasting, namely: The Role of Forecasting in Utility Planning, B.F. Roberts, Economic Sciences Corporation; Long-Run Forecasting - Inputs and Outputs, T.A. Yancey, University of Illinois; New Factors in Electric Load Forecasting, Robert W. Shaw, Jr., Booz.Allen and Hamilton, Inc.; Role of Regulatory Agencies in Load Forecasting, Darrell Smith, Temple, Barker, and Sloan, Inc.; and Future Challenges Facing the Electric Utility Industry, James J. O'Connor, Commonwealth Edison Company.

51817 (CONF-7809138—, pp 59-90) **Planning and siting.** (Illinois Power Co., Decatur). 1978.

From 6. annual Illinois energy conference on electric utilities; Chicago, IL, USA (27 Sep 1978).

The five papers presented at the planning and siting session are: Siting - A Key in Capacity Planning, Porter J. Womeldorff, Illinois Power Company; Impact of Clean Air Act Amendments on Power Plant Siting - A Utility View, Richard J. Grant, Central Illinois Public Service Company; Impact of the Clean Air Act on Power Plant Siting - An Environmental View, Martin Wagner, U.S. EPA; Nuclear Power Plant Siting in Illinois, Robert V. Laney and Philip F. Gustafson, Argonne National Laboratory; Current Activity in Illinois Siting Legislation, Tor D. Kolflat, Illinois Energy Resources Commission.

51818 (CONF-7809138—, pp 91-138) **Reliability.** 1978.

From 6. annual Illinois energy conference on electric utilities; Chicago, IL, USA (27 Sep 1978).

The session on reliability contains four papers, namely: The Adequacy and Reliability of the Bulk Electric Power System of North America, Walter J. Matthews, National Electric Reliability Council; Reliability - After Planning, What Then, Kenneth E. Wolters, Wisconsin Electric Power Company; Costs ad Benefits of Over/Under Capacity in Electric Power System Planning, Edward G. Cazalet, Decision Focus, Inc.; and Costs and Benefits of System Reliability, Louis A. Guth and Harriet Zellner, National Economic Research Associates, Inc.

51819 (CONF-7809138—, pp 139-200) **Rates and financing.** 1978.

From 6. annual Illinois energy conference on electric utilities; Chicago, IL, USA (27 Sep 1978).

Six papers make up the session on rates and financing, namely: The problems of Utility Financing, Gordon R. Corey, Commonwealth Edison Company; Effects of Changes in Regulations and Tax Laws on Electric Utility Financing, George Tolley and Stuart Townsend, University of Chicago and WAPORA, Inc., respectively; Introduction to Electric Utility Rate Structure, Richard D. Cudahy, attorney, Isham, Lincoln, and Beale; Regulatory Response in a Dynamic Economy, Michael Schmidt, Illinois Commerce Commission; The Application of Marginal-Cost Pricing to Regulated Utilities, Charles J. Cicchetti, Public Service Commission of Wisconsin; and Federal Role in Utilities Rate Design, Hazel R. Rollins, Economic Regultory Administration, US DOE.

51820 (CONF-7809138—, pp 201-247) **Future development.** (Minnesota Energy Agency, St. Paul). 1978.

From 6. annual Illinois energy conference on electric utilities; Chicago, IL, USA (27 Sep 1978).

Five papers presented at the session on future developments are: District Heating and Cogeneration as an Integral Part of Minnesota's Energy Policy and Conservation Plan, Ronald E. Sundberg, Rod Leas, and Hans Nyman, Minnesota Energy Agency; Solar Buildings and Electric Utilities, Paul Sullivan, Total Environmental Action, Inc.; Residential Electric Heating and Cooling - Total Cost of Service, J.G. Asbury, R.F. Giese, and R.O. Mueller, Argonne National Laboratory (see EAPA 5:2224); The Isolation of High-Level Radioactive Waste, Fred A. Donath, University of Illinois; and What Happened to the Energy Crisis, Abner J. Mikva, US Representative from Illinois.

51821 (DOE/ET—0012/2(Rev.)) **Systems engineering for power. Program report.** (Department of Energy, Washington, DC (USA). Div. of Electric Energy Systems). Jun 1979. 372p. P 16/MF A01.

The central objective of the program is to develop and make available to the electric utility industry the conceptual tools needed for the planning, engineering, and operation of the electric energy systems of the future. The perceived increase in complexity is being driven by three trends, each of which compounds the others. An increasing degree of interconnection between operating areas; development of new technologies; and a continual tightening of the constraints within which the electric energy system must operate, including financial, environmental, and conservationn constraints are perceived. Each of these driving forces has implication for system operation (control) and for system design (planning). This report defines the subprograms which have thus far been developed for control and planning. Systems control subprograms concern more efficient, economical operation; operation within smaller reserve and stability margins; control of unconventional elements; and improved modeling and simulation capability. Systems development and forecasting subprograms concern improved systems structuring; improved systems analysis; and improved forecasting and planning means.

51822 (HCP/B8681—01/1) **Technical, institutional, and economic analysis of alternative electric rate designs and related regulatory issues in support of DOE Utility Conservation Programs and Policy. Volume I. Domestic rate survey.** (ICF, Inc., Washington, DC (USA)). May 1979. Contract EM-77-C-01-8681. 161p. P 08/MF A01.

Certain electric rate structures currently offered or actively proposed by United States Class A and B utilities are reviewed, focusing on six major areas: (1) rates that apply to backup electricity for solar space and/or water heating systems; (2) rates that contain demand (kW) charges for residential customers; (3) rates that contain flat or flattened energy charges for residential customers; (4) rates to residential, commercial, and industrial customers who allow the utility to control part or all of their loads; (5) rates that apply to customers who cogenerate part or all of their electricity, and prices paid by the utility for purchases of cogenerated electricity from the customer; and (6) rates offered by energy-constrained electric utilities that rely primarily on hydropower. A discussion of each area is contained in Chapters II through VIII, respectively. Filed tariffs that pertain to the above six areas are identified throughout the text. Copies of these tariffs are provided in a separately bound Appendix. Appendix A presents the results of a survey by Edison Electric Institute on rate-structure innovation. Appendix B contains a survey conducted by ICF on time-of-day electric rates.

51823 (HCP/B8681—01/2) **Technical, institutional, and economic analysis of alternative electric rate designs and related regulatory issues in support of DOE Utility Conservation Programs and Policy. Volume II. Foreign rate survey.** (ICF, Inc., Washington, DC (USA)). May 1979. Contract EM-77-C-01-8681. 77p. P 05/MF A01.

This volume contains a survey review of various electric rate structures offered by major utilities outside the US. Information is included from Australia, Canada, Finland, Israel, Japan, New Zealand, Norway, Sweden, United Kingdom, and West Germany. The survey focuses on the same six areas as the Domestic Survey (Vol. 1), namely: (1) rates that apply to backup electricity for solar space and/or water heating units; (2) rates that contain demand (kW) charges for residential customers; (3) rates that contain flat energy charges for residential customers; (4) rates to residential, commercial, and industrial customers who allow the utility to control part, or all, of their loads; (5) rates that apply to customers who cogenerate part or all of their electricity, and the prices paid by utilities for purchases of cogenerated electricity from these customers; and (6) rates offered by energy-constrained electric utilities that rely primarily on hydropower. Appendix A contains tariff schedules for selected utilities. All sources used in preparation of this volume are listed in Appendix B.

51824 (LBL—9233) **Data needs for regional residential electricity sales forecasting.** Blumstein, C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1979. Contract W-7405-ENG-48. 12p. (CONF-790848—1). P 02/MF A01.

From Annual meeting of the Urban and Regional Information Systems Association; San Diego, CA, USA (19 Aug 1979).

In recent years increasing attention has been devoted to the problem of forecasting electricity sales. One consequence of this increased interest has been the advent of end-use models for forecasting residential electricity sales. These models disaggregate electricity sales into end uses such as heating, cooling, refrigeration, cooking, and lighting. They make it possible to examine future electricity requirements in some detail. However, the use of these models requires very large amounts of data. Regional residential electricity sales models developed by the California Energy Commission provide an illustration of these requirements and of the difficulties that may be encountered in satisfying them.

51825 **State energy master planning and long-range electric and gas system planning: Parts 7840—7866. Title 9, Executive, Volume D, Subtitle BB.** New York, NY; New York State Energy Office (1978). 73p. (NP—23858).

It is the policy of New York to conduct energy planning in an integrated and comprehensive manner through development of a long-range energy master plan which shall provide the framework for energy-related decisions throughout the state. Elements of this framework include the State Energy Master Plan and the Long-Range Electric and Gas Report. The text of this Master Plan is presented in 4 subchapters: General Provisions, Procedures, Plans of Major Energy Suppliers, and Periodic Data; Submissions of Major Petroleum and Coal Suppliers.

ELECTRIC POWER GENERATION

REFER ALSO TO CITATION(S) 51209, 51421, 51787, 51807, 51831, 51839, 51843, 51844, 51870, 51882, 52145, 52403

51826 (TID—28839) **Commercialization strategy report for advanced electric generation technologies.** (Department of Energy, Washington, DC (USA)). 1978. 75p. P 04/MF A01.

Advanced technologies for electric generation have the potential for making a significant impact by the 1990s. The principal contenders are: atmospheric fluidized-bed combustion, fuel cells, and combined cycle with integrated coal gasifier. Technical, market/economic, environmental, institutional readiness aspects and benefits analysis for each of the candidate technologies are presented.

51827 **R & D planning for the electric utility industry.** Rudman, R.L.; Starr, C. (Electric Power Research Inst., Palo Alto, CA). pp 193-217 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

For a new energy technology, the transition from scientific feasibility to commercial availability typically takes 20 to 40 years - if everything works perfectly. Similarly, decades are required from the time of commercial introduction to the time of significant energy impact for a new technology. Virtually all proposed alternative energy technologies have a long way to go before the demonstration

of a system that is feasible technically, economically, and institutionally. There are many technologies that meet two of these three criteria, but that is not enough. All of the solar technologies are technically and will probably be institutionally feasible, but their use is constrained by high cost. Geothermal energy use is limited by the locations and total quantities of the resource, by many unresolved institutional issues, and, for several geothermal methods, by technical uncertainty. The fast breeder reactor appears to be technically and economically feasible, but institutional obstacles slows its development. Fusion energy is not yet technically feasible. We are many years from accurate economic estimates and knowledge of institutional requirements for this option. Economic feasibility is just as important as technical feasibility. The electric utilities require about one-sixth of total annual business capital. A substantial increase in cost for novel technologies could only come at the expense of other industrial investments. An active research, development, and demonstration program for new energy options is essential due to the long development times for these options. Until these technologies are proven, we cannot abandon the existing technologies of nuclear power and fossil-fuel use.

ELECTRIC POWER TRANSMISSION AND DISTRIBUTION

REFER ALSO TO CITATION(S) 52239

CONSUMPTION AND UTILIZATION

REFER ALSO TO CITATION(S) 51852, 51867

51828 (UCID—18221) **California energy flow in 1977.** Borg, I.Y. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Jul 1979. Contract W-7405-ENG-48. 13p. P 02/MF A01.

The supply and use of various forms of energy in California in 1977 has been collected and assembled in an energy flow chart. Overall energy consumption increased 5% in 1977 over 1976; the bulk of the increase was possible because of larger imports of foreign and increased production of domestic crude oil. the natural gas supply remained constant and because of the mild winters of 1976 to 1977 and 1977 to 1978 was used to a greater degree for electrical power generation. The 1977 drought seriously impacted both imported and domestic hydroelectric power. The power deficit was met by increased use of gas and especially oil as boiler fuels. Coal use remained constant; although out-of-state power from coal-fired plants in Arizona, Nevada, and New Mexico increased slightly. Use of energy in the transportation sector increased 10%; use of motor gasoline and aviation gasoline and jet fuels increased to the same degree.

51829 **Demand for electrical energy by agriculture in the USA.** Uri, N.D. (Dept. of Energy, WA). *Energy Econ.;* **1**: No. 1, 14-18(Jan 1979).

U.S agricultural consumers are found to respond significantly to higher electricity prices, although the relative inelasticity of demand requires a large change in price in order to restore equilibrium. Estimates of 1975 to 1977 price and demand equations for electricity are based on data from 48 states. Price elasticity is shown to be adequate when the market mechanism is used to curtail demand. 10 references.

UNCONVENTIONAL SOURCES AND POWER GENERATION

REFER ALSO TO CITATION(S) 51827

51830 **Alternative Renewable Energy Sources Program: report to the Montana Legislature.** Helena, MT; Montana Department of Natural Resources and Conservation (1979). 63p.

When the Montana Legislature passed Senate Bill 86 establishing the Montana Alternative Renewable Energy Sources Program in 1975, it mandated that the program seek ways to lessen Montana's reliance on nonrenewable energy sources. Every project funded by the program has sought to decrease reliance on conventional fuels by either: generating such needed information as solar insolation data; demonstrating the workability of different energy forms by installation of individual renewable energy systems; or by developing new approaches for more effective use of the renewable energy sources in Montana. The report begins with a history of the program and the function of those involved with the reviewing and granting of renewable energy projects (biomass; geothermal; small-scale hydropower; solar; wind; wood; and education/technical assistance). The next two chapters provide a discussion of the grants awarded to date and the operational procedures of the program. A brief overview of program activity with the renewable energy sources follows. The next chapter outlines the methods used to provide information to the public. The final chapter is a summary and evaluation of the program. (MCW)

SOLAR

REFER ALSO TO CITATION(S) 51210, 51212, 51215, 51216, 51217, 51218, 51219, 51220, 51221, 51222, 51223, 51224, 51225, 51226, 51228, 51229, 51230, 51267, 51268, 51280, 51294, 51295, 51298, 51314, 51435

GEOTHERMAL

REFER ALSO TO CITATION(S) 51383, 51399

OTHER

REFER ALSO TO CITATION(S) 51263, 51843, 51844, 51879

51831 (ORO—5682-8) **Development of wood as an alternative fuel for large power generating systems. Annual report, January 3, 1978—October 31, 1978.** Hamrick, J.T. (Aerospace Research Corp., Roanoke, VA (USA)). Oct 1978. Contract ET-78-C-05-5682. 82p. P 05/MF A01.

The objective of the overall project is to develop a system for retrofitting fossil-fuel-fired boilers to burn wood. This effort is expected to provide the data for the design and fabrication of a prototype combustion module which will provide the design information for retrofitting of large-scale boiler systems. To achieve this objective, a small combustion module was designed, fabricated, and run as an integral part of this effort. This apparatus was used for parametric studies of wood pyrolysis and combustion with hot air. Tests in the module have shown that green wood, when pulverized to pass a half inch screen, burns in much the same manner as natural gas or oil when the primary and secondary air temperature is 1000°F. Tests have been made with primary and secondary air temperatures up to 1040°F and with air/fuel ratios varying from stoichiometric to 92% excess air. The maximum green wood feed rate was 1272 lbs per hour with a heat generation of 5.5 million Btu per hour. With heat loss due to the moisture in the wood having been taken into account, the overall heat release rate for the furnace with 1272 lbs of green wood per hour was 13,445 Btu per cubic foot per hour. The burning of the particles while in suspension was determined to be essentially complete with excess air in the 20 to 36% range and nearly so with no excess air when both primary and secondary air enters at 1040°F. Results of an analysis of the burning in the module indicate that a 60,000 Btu/ft^3/hr heat release rate can be achieved. Further performance tests on combustors and pulverizers and the retrofitting of a gas- or oil-burning central power station to burn wood are recommended.

ENERGY CONVERSION

51832 **Materials and economics of energy systems.** Frankel, H.E.; Daphunas, S.J. pp 726-737 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

General data are presented for energy systems which identify generic materials problems in energy systems as well as the economic benefits to be gained from materials research and engineering and to lend credence to the statement that materials are a barrier to economic energy production. Materials and economics involved in magnetohydrodynamics, solar electric power, coal gasification, coal liquefaction, power plants, and geothermal conversion are discussed in some detail. The central theme has been offered and developed that materials are the primary point which often times can make or break an energy system. (MCW)

51833 **Reversible thermoelectric power conversion of energy fluctuations.** Yater, J.C. (Energy Unlimited, Inc., Lincoln, MA). pp 107-114 of Second international conference on thermoelectric energy conversion. Rao, K.R. (ed.). New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1978).

From 2. conference on thermoelectric energy conversion; Arlington, TX, USA (22 Mar 1978).

The results are given of the analysis of a device for utilizing with high efficiency the electric fluctuation energy of small circuits thermally insulated from other small circuits at a different temperature so as to produce useful energy. This reversible thermal electric power converter can also efficiently pump heat from lower to higher temperatures. Applications of this device are presented along with a discussion of some design goals for the development of the device.

MHD GENERATORS

51834 Second international conference on thermoelectric energy conversion. Rao, K.R. (ed.). New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1978). 143p. (CONF-780382—).

From 2. conference on thermoelectric energy conversion; Arlington, TX, USA (22 Mar 1978).

Separate abstracts were prepared for the 29 papers presented. Three of the papers are included as a supplement. (WHK)

DESIGN AND DEVELOPMENT

51835 (ANL/MHD—78-5) **Liquid-metal MHD energy conversion. Status report, March 1976—September 1977.** Petrick, M.; Dunn, P.F.; Pierson, E.S.; Dauzvardis, P.V.; Pollack, I. (Argonne National Lab., IL (USA)). May 1979. Contract W-31-109-ENG-38. 156p. P 08/MF A01.

A new open-cycle coal-fired liquid-metal MHD concept has been developed, in which the combustion products are mixed directly with liquid copper and the mixture is then passed through the MHD generator. This concept yields a system with an efficiency comparable to that of open-cycle plasma MHD at combustor temperatures as much as 1000 K lower and MHD generator temperatures more than 1000 K lower than is the case for open-cycle plasma MHD. Significantly, the liquid-metal system uses components that are close to or within present-day technology, and it appears that readily available containment materials are compatible with the fluids. The first commercial system studies for the liquid-metal Rankine-cycle concept show that it yields a higher conversion efficiency than conventional steam cycles for lower-temperature heat sources, such as a liquid-metal fast-breeder reactor, a light-water reactor, or solar collectors without any potential for hazardous reactions betweeen liquid metals (e.g., sodium) and water. Fabrication of the high-temperature liquid-metal MHD facility has been completed, and shakedown runs have been performed, using a substitute mixer-generator test section. Data obtained in this test section agreed well with existing single-phase and newly-developed two-phase correlations for the pressure gradient.

MATERIALS, COMPONENTS, AND AUXILIARIES

51836 (FE—6010-12) **Development, testing and evaluation of MHD-materials. Quarterly report, April—June 1978.** Hosler, W.R.; Negas, T.; Schneider, S.J. (National Bureau of Standards, Washington, DC (USA). Center for Materials Science). 30 Jun 1978. Contract EA-77-A-01-6010-035. 112p. P 06/MF A01.

The overall objective of this program is to obtain chemical and physical definition of high temperature materials which have shown promise for use in coal-fired open-cycle MHD power systems. Initial results on a coal slag intermediate in composition to Illinois No. 6 and Montana Rosebud slags show that the log viscosity is raised about 20% by a 15% concentration of K_2O seed. Slag exposed to pressurized steam undergoes a change that increases the log viscosity by about 5%. The pre-test electrical conductivity of the U-02 Phase III materials has been completed. Analysis of diffusion between MAFF 31 ($3MgAl_2O_4.Fe_3O_4$) electrode material and $MgAl_2O_4$ insulator material showed that the diffusion coefficients at 1600°C for Mg were at least twice as large as those for Al, although Fe diffusion was still the dominant metal diffusion process. The electrochemical effects in a simulated slag flow using platinum electrodes indicate substantial attack on the cathode electrode and minimal effect on the iron depleted layer on the anode. Approximately 50 materials from external sources have been analyzed structurally by x-ray diffraction methods. The post test analysis of the electrodes tested at MIT February 28, 1978 (MIT 228-NBS F) has been completed. Stainless steel 304 was tested in the hot corrosion apparatus for 4 hours at 550°C using K_2SO_4. Extensive corrosion was not detected although discontinuous and localized oxidation/sulfidation was noted. Physical property data and prices are given on two new alloys that may prove to be more cost effective than 310 SS where sulfidizing is a problem such as the seed recovery system.

51837 (PNL—2004-10) **Development, characterization and evaluation of materials for open cycle MHD. Quarterly report for the period ending December 1978.** Bates, J.L.; Marchant, D.D. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1979. Contract EY-76-C-06-1830. 58p. P 04/MF A01.

The objectives of this program are to develop, test, characterize, and evaluate materials for open-cycle, coal-fired MHD power generators. The specific immediate goals emphasize electrode and insulator materials, including: (1) testing and evaluation of the enhanced effects of alkali seed on materials in a dc electric field; (2) development and testing of improved electrodes and insulators with controlled microstructures, compositions and properties; and (3) characterization and evaluation of materials relating to both the US MHD Program and the US-USSR Cooperative Program for MHD power generators. The scope of this program encompasses the following areas: (1) reproducible laboratory testing of both ceramic and metal electrode materials and insulator materials in alkali seed/slag under dc electric current and voltages, as functions of temperature, and seed/slag composition; (2) development and fabrication of electrodes, insulators, and other related materials with controlled electrical, chemical, and physical properties, including evaluation in laboratory tests in US MHD test facilities and as part of the US-USSR testing program; and (3) characterization and evaluation of materials tested under the US-USSR and the US MHD programs including the measurement and analysis of structural, chemical, and thermophysical properties of electrodes, insulators, slag, and other related materials before and after testing. Progress is reported.

DUCT ENGINEERING AND FLUID DYNAMICS

51838 (AD-A—060429) **Magnetohydrodynamic lightweight channel development. Final report, 28 November 1975—31 December 1977.** Swallom, D.W.; Sonju, O.K.; Meader, D.E.; Heskey, G.T. (Maxwell Labs., Inc., Woburn, MA (USA)). Jun 1978. Contract F33615-76-C-2001. 170p. Y A08/MF A01.

A lightweight, high performance MHD channel and diffuser were designed, built, and tested. The hardware was designed for testing with toluene and oxygen. The design power level of 200 kW dc was obtained during the 125 tests. The MHD channel design was a diagonal conducting wall generator with calcia stabilized zirconia electrodes and a filament wound epoxy coated fiberglass outer shell. The diffuser design utilized thin wall copper construction with external cooling tubes. These designs resulted in a significant reduction of the masses of the channel and diffuser. The masses of the channel and diffuser were 40 kg and 24 kg, respectively, which compared favorably to previous channels and diffusers of similar performance characteristics with masses of 160 kg and 150 kg, respectively. The novel design features of the channel construction technique included the use of a filament wound, epoxy coated fiberglass structural shell, the presence of an RTV layer to provide the pressure seal, and the minimization of the use of the copper material in the electrode frames. This fabrication procedure combined to provide a lightweight channel capable of withstanding sustained operation under a wide variety of operating conditions.

PERFORMANCE AND TESTING

REFER ALSO TO CITATION(S) 51936

THERMIONIC CONVERTERS

PERFORMANCE AND TESTING

51839 Increasing the efficiency of coal-fired steam electric plants with thermionic topping. Merrill, O.S. (Dept. of Energy, Washington, DC); Gunn, M.; Huffman, F.N.; Fitzpatrick, G.O. pp 971-978 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Today's electric power plants reject to the environment approximately two-thirds of their available fuel energy. One of the major reasons for this waste is the narrow range of temperatures over which conventional power plants operate. The steam cycle commonly used in central station power plants operates over the temperature interval of 1000 to 100 F. Yet primary fuel combustion temperatures of 4500 F are available. One of the most promising means of increasing power plant efficiency is to convert part of the high-temperature heat available between the combustion and steam-utilization temperatures into electricity before the balance of the heat is used in the conventional steam cycle. Preliminary systems studies indicate that combined thermionic-steam cycle central station power plants may be both highly efficient and economical.

FUEL CELLS

DESIGN AND DEVELOPMENT

51840 (EPRI-EM—1010) **Assessment of fuel processing systems for dispersed fuel cell power plants.** Tio, T.; Jones, R.; Minet, R. (Kinetics Technology International Corp., Pasadena, CA (USA)). Mar 1979. 130p. P 07/MF A01.

Fuel cell power plants currently entering the commercialization stage are limited to the use of light, low sulfur fuels. The objective of this report is to identify a fuel processing system which is capable of processing heavier fuels and can be integrated with the fuel cell in a manner that meets power plant efficiency and cost goals. The report assesses the Toyo Engineering Corporation Total Hydrocarbon Reforming (THR) process and the Societe Chimique de la Grande Paroisse Fluidized Bed process and concludes that neither of these processes, alone, will meet the project efficiency

goals. However, a hybrid system is identified, combining the Toyo THR process with an Autothermal Reactor, which shows excellent potential for meeting the desired objectives. This hybrid system is analyzed for a range of operating conditions to obtain an optimum overall efficiency. A conceptual design for the optimized system, integrated with a dispersed phosphoric acid fuel cell generator (5MW), is presented based on use of conventional equipment. Sizing of major equipment, selection of candidate materials of construction, and a capital cost estimate for the overall fuel processor are discussed. Potential problem areas are identified and recommended future development efforts for this highly promising system are proposed.

51841 (EPRI-EM—1097) **Fuel cell power plant integrated systems evaluation.** Bonds, T.L.; Dawes, M.H.; Roberts, R.; Schnacke, A.W.; Spradlin, L.W. (General Electric Co., Schenectady, NY (USA). Energy Systems Programs Dept.). Jun 1979. 106p. P 06/MF A01.

Molten carbonate fuel cell power plants are candidates for two future utility applications. One application would be as small dispersed generators using liquid or gaseous fuels. The other would be as central station power plants fueled by coal. The activities conducted to develop and analyze molten carbonate fuel cell power plant design configurations for these two applications are described. Both small (5 MW) dispersed, oil-fueled and large (675 MW) coal-fueled power plants are considered. Plant requirements have been established and they include a heat rate of 7500 Btu/kWh for the oil-fueled plant and 6800 Btu/kWh for the coal-fueled plant. Described are the activities that will lead to the selection of a reference power plant design for each of the power plant types. These reference cycles will form the basis for assessments directed at economic evaluations and trade-offs designed to further improve and detail the plants. Plant design guidelines and the analytical methodologies developed in the course of this program are presented. Seven coal-fired and one oil-fueled plant configurations are identified and discussed. Three of the coal-fueled cases meet the heat rate goal. The oil-fueled case calculates to a 7882 Btu/kWh heat rate - the report discusses a means of more closely approaching the goal in this case.

51842 (EPRI-EM—1134) **Integral cell scale-up and performance verification. Final report.** Handley, L.M.; Houghby, W.E.; Johnson, W.H.; Schiller, T.G.; Stryker, H.Y. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). Jun 1979. 57p. P 04/MF A01.

The prime objective of the program was to scale the integral cell configuration ot the 4.8-MW Demonstrator cell size (3.7-ft^2) and test the full-size packages in short cell stacks to verify the acid management capability and document performance. The integral cell configuration is an arrangement in which the ribbed flow-field structures on the conventional phosphoric acid fuel cell separator are placed instead on the adjacent electrode substrates. The ribs continue to serve the functions of distributing reactant gas and conducting current and heat. The ribs are porous like the rest of the substrate and therefore can also be used to store electrolyte. Low-cost cell stack construction techniques devised in other programs were refined, and materials were modified to produce improved cell stack components. A 1530-hour test of a 20-cell stack demonstrated that the performance of the integral cell configuration was equivalent to that of the 4.8-MW Demonstrator configuration, and that increased acid inventories (necessary to meet endurance goals) could be accommodated in the electrodes without severe performance penalties. A second objective was to investigate improvements in acid cell stack technology that would be sufficient to allow a 20-percent reduction in total active cell area (and consequently lower cell cost) relative to the Demonstrator. Improvements to previously developed catalysts, catalyst layers, and application techniques were investigated, and subscale 2" x 2" single cell endurance tests were conducted. A 15-mV performance improvement over the Demonstrator performance projection was shown after 10,000 hours at 300 ASF, 375°F, 50 psia endurance test conditions. The third objective was the initiation of a cell stack conceptual design incorporating the integral cell concept.

PERFORMANCE AND TESTING

REFER ALSO TO CITATION(S) 51842

51843 **Development of central station power plants integrated with coal gasifiers.** Ackerman, J.P. pp 455-456 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

The objective of the DOE program on molten-carbonate fuel cells is the earliest feasible implementation of clean efficient power plants operating on coal. Molten-carbonate fuel-cell power plants were identified to have the most desirable combination of overall efficiency (49 to 50%) and cost of electricity (0.029/kWh) of any of the advanced technologies for generation of baseload power. In addition, emissions of sulfur oxides (0.1 lb/MBtu fuel input) and nitrogen oxides (0.03 lb/MBtu) will almost certainly be well below anticipated standards, and current planning calls for heat rejection to air. DOE has as its goal the operation of a coal-fueled generator of approximately 50% efficiency before 1990. A number of intermediate milestones must be achieved to provide the technical and economic basis for proceeding with the construction of these large (500 MW) power plants. Among these are: the successful operation of smaller, less efficient power plants (1978), testing of molten-carbonate fuel-cell stacks on coal gasifier output (1982 to 1985), and successful operation of small dispersed fuel cell generators retrofitted with molten-carbonate stacks (1983). Substantial benefits could be derived from installation of small, coal-fueled, industrial cogeneration plants beginning in the mid 1980's; this application is being investigated. The critical elements of technology in this program are integration of the fuel cell subsystem with the gasifier and other subsystems, and the development of the fuel cells themselves.

MATERIALS, COMPONENTS, AND AUXILIARIES

REFER ALSO TO CITATION(S) 51840

APPLICATIONS

51844 **Role and status of dispersed electric-utility fuel-cell power plants.** La Stella, J.P. (Consolidated Edison Co. of New York, NY). pp 447-454 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Studies into the viability of fuel cell power plants have involved the investigation of the Fuel Cell Generator-1 project, leading to the development, construction, and operation of a 1-MW fuel-cell pilot power plant. This test was completed in June 1977. The success of this test is the forerunner of the first full-sized modular 4.8-MW Demonstrator unit which will be packaged as 6 modular units for future 26-MW power plants. The manufacture of the 4.8-MW Demonstrator is being funded by DOE, EPRI, and United Technologies; the host utility was selected to be Con Edison. This paper discusses the progress of the program and outlines its main objectives. The basic advantages of the fuel cell concept are: environmental compatibility, dispersed generation, high efficiency and load-following capability, and modular concept. The author concludes that fuel cells are particularly attractive for use in heavily populated environments where sites suitable for the construction of conventional plants have become unavailable. (MCW)

ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 51771, 51793, 51797, 51828

51845 (CONF-7709114—, pp 24p, Paper 9) **Overview of grid-connected Integrated Community Energy Systems (ICES) demonstration projects.** Davis, S.A. (Argonne National Lab., IL). 1977.

From 3. ERDA energy management symposium; Knoxville, TN, USA (19 Sep 1977).

The grid-connected Integrated Community Energy System (ICES) is a cogeneration concept utilizing plant and distribution systems optimized for the community thermal energy demand. Electrical power is generated as a by-product which at times may exceed the community electrical demand. Therefore, the system is operated in parallel with a utility to provide an interchange of electricity to the grid. The result is more-efficient fuel utilization with resultant economic benefits. The objective of ERDA's grid-connected ICES demonstration program is to show that such systems using current technology can be designed, constructed and operated in a manner which is: (a) conserving of energy and scarce fuels, (b) economically and environmentally viable, and (c) feasible from an institutional perspective; thereby enhancing the rate of commercialization.

51846 (CONS—8180-T1) **State energy conservation plan for New Mexico.** (New Mexico Energy and Minerals Dept., Santa Fe (USA)). 1978. Contract EM-76-F-01-8180. 423p. P 18/MF A01.

The energy-savings and energy0-management programs set up by state agencies in New Mexico are presented. Also the energy-savings and energy-management programs for public schools are presented. Plans and summaries are also given for the following program: solar water heaters for secondary schools; solar portable classroom demonstration; energy-savings and energy-management programs for county and municipal governments; energy-savings programs for commercial and residential sectors; weatherization;

solar sustenance; energy-savings programs for hospitals and industrial buildings; carpools and vanpools; a program encouraging compliance with the national 55-mph speed limit; waste-oil recycling; utilitites; agriculture; procurement; modification; public information; and an administrative packet containing information on how to facilitate internal accounting procedures.

BUILDINGS

REFER ALSO TO CITATION(S) 52134

51847 (CONF-7709114—, pp 8p, Paper 10) **Infrared survey experience: Brookhaven National Laboratory.** Jacobson, L.A. 1977.
From 3. ERDA energy management symposium; Knoxville, TN, USA (19 Sep 1977).

Infrared thermography is a technique of portraying an object using the thermal energy (infrared) radiating from the surface of the object. The increasing emphasis on energy conservation has stimulated the use of infrared thermography as a means of detecting sources of energy waste. The equipment, procedures, and results of infrared surveys made at BNL are discussed.

51848 (CONF-7709114—, pp 21p, Paper 11) **Successful energy-conservation measures.** Choat, E.E. (Oak Ridge Y-12 Plant, TN). 1977.
From 3. ERDA energy management symposium; Knoxville, TN, USA (19 Sep 1977).

This presentation describes three successful energy-conservation measures. The first of these, consists of a summary and up-date of an energy conservation study of an existing office building. In addition to a summary of the original paper, a comparison of predicted energy savings vs actual savings over a two-year period is made. The second successful measure consists of a summary of a study of a conceptual design for a new laboratory which was completed prior to the energy-conservation era. This study, made subsequent to the energy crisis, illustrates that significant savings are possible during the design phase without excessive cost. Finally, the conversion of steam plants in the ORO facilities to burn coal in lieu of gas and oil is described.

51849 (SIB-R—77-1978) **Evaluation of an energy conserving ventilation system with laminar air flow and a general study of the principle.** Belin, K. (Statens Inst. foer Byggnadsforskning, Stockholm (Sweden)). 1978. 90p. (In Swedish). U 05/MF A01.
The function of laminar air flow ventilation systems has been studied as well as the possibilities to save energy by applying the system. The system is described and experimental results of the investigations of the importance of the sizes of different factors for the efficiency of the system are presented in curves.

RESIDENTIAL BUILDINGS

REFER ALSO TO CITATION(S) 51302, 51303, 51753, 51756, 51824, 51860

51850 (DOE-tr—185) **Information on the fundamental improvement of a private home: save money, energy, and this guide.** (Ministry of Trade and Industry (Finland)). [nd]. Translation source information not available. 77p. P 05/MF A01.
This guide, published by the Finnish Ministry of Trade and Industry, contains information on how to improve houses in order to minimize costs for maintenance and heating and to improve comfort. (LCL)

51851 (BNL—50968) **Case study of the Brownell low energy requirement house.** Jones, R.F.; Krajewski, R.F.; Dennehy, G. (Brookhaven National Lab., Upton, NY (USA)). May 1979. Contract EY-76-C-02-0016. 79p. P 05/MF A01.
An evaluation is made of the design and thermal performance of an innovative house built in 1977 in the Adirondacks area of New York State. The house has a very tight and well-insulated envelope, with the rigid insulation board applied to the outside of the frame. Passive solar gain through south-facing glass, along with internal free sources of heat, are shown to provide a substantial part of the building's heating requirements. Effective integral thermal storage, provided by the exposed interior structure, serves to keep interior temperature excursions within acceptable limits. Additional remote storage is provided in the form of a large thermal storage sand bed, with air ducts, located below the basement floor. Calculations and measured performance data show that the house's space heating needs are only about 40% of those of a similar size house built to HUD minimum property standards, and less than 25% of those of a typical inventory house in the Northeast United States.

51852 (EPRI-EA—1100) **Analysis of household appliance choice. Final report.** (Charles River Associates, Inc., Boston, MA (USA)). Jun 1979. 212p. P 10/MF A01.
Econometric discrete choice models have been developed to analyze consumer choices in certain situations. This study surveys the existing literature on discrete choice models and assess their applicability to appliance-choice problems. Several models are estimated in trial applications which deal with space conditioning and air conditioning choices. The study examines the factors that affect household-appliance choices, particularly those relating to space-conditioning systems. It then surveys and disucsses a number of modeling approaches such as the multinominal logit model and its extensions. The sequential logit model and two versions of the probit model were selected as candidates for empirical testing. Available disaggregate data were assessed for use in estimating appliance choise models. The data collected for EPRI by the Midwest Research Institute (MRI) were selected for current empirical work. A probit model of room-air-conditioner choice along with probit and sequential logit models of household space-conditioning systems were estimated using the MRI data. Two other issues were addressed in the study: sampling methodologies and methods of aggregating households. Special estimation methods are required if samples are stratifid using some variable associated with the applicace choice. The most-promising methods appear to be weighted maximum-likelihood estimators. Several approaches to aggregating households were discussed and an aggregation exercise was performed for the sequential logit model of space conditioning system choice.

51853 (ORO—5552-4(Vol.3)) **Improving the efficiency, safety, and utility of wood burning units. Quarterly report No. WB-4.** Dyer, D.F.; Maxwell, T.T.; Maples, G. (Auburn Univ., AL (USA). Dept. of Mechanical Engineering). 15 Sep 1978. Contract EC-77-S-05-5552. 345p. P 15/MF A01.
The design and test results for 16 wood burning stoves are presented. (TFD)

51854 (PB—288157) **Residential water conservation. Masters thesis.** Weakley, W.P. (Colorado Univ., Boulder (USA)). 1977. 236p. Y A11/MF A01.
The feasibility of using various water conservation measures to reduce residential water demand was examined. Ten conservation techniques were found to be relevant. These included meters, recycle systems, devices, pressure and flow reducers, public education, restrictions, building and plumbing codes, horticultural changes and pricing. Each measure was evaluated and various combinations were assessed to develop viable alternative options. Costs and benefits were also evaluated. Water savings of 30 to 40% were possible through imposition of programs of water conservation. A case example of application of such a program for Lyons, Colorado is included.

51855 (STU—77-5677) **COMFOTERM: a system for energy conservation by individual charging of the fuel costs in apartment houses.** Welin, E. (Styrelsen foer Teknisk Utveckling, Stockholm (Sweden)). Mar 1979. 7p. (In Swedish). (STU—76-4850; STU—74-5192). U 02/MF A01.
The heating of buildings consume more than half of the totally consumed energy in Sweden. The apartment houses consume about one third of this amount. The mean temperature in the apartments is 23 to 24°C, while the corresponding figure for villas is several degrees lower. One explanation for this discrepancy is that the owner of the villas pay their heat themselves, while the fuel costs in apartment houses usually are divided between the different apartments taking into account the areas of the flats. By the introducion of individual charging of fuel costs also in apartment houses the energy consumption will decrease drastically (5 to 6% per °C). A system for individual charging based on the mean temperature indoors is presented.

OFFICE BUILDINGS

REFER ALSO TO CITATION(S) 51795, 51796, 51861

51856 (HCP/M5250—01/1) **Making cents of your energy dollar. Volume 1. Energy audit.** (Energy Conservation and Alternatives Center for Commerce and Industry, Denver, CO (USA)). Jun 1979. Contract EM-78-G-01-5250. 118p. P 06/MF A01.
This handbook is directed at conducting an energy audit and is a vehicle to establish an energy management program. It is primarily a guide to the identification and correction of inefficiencies in building energy systems and a practical handbook for energy management task forces. It may also be an aid in the training of state energy auditors and/or operational personnel/managers of schools, hospitals, and public buildings pursuant to the National Energy Conservation Policy Act of 1978. Further, it is suitable for use by para-professionals implementing the energy audit phase of the schools/hospitals/public buildings program.

51857 (HCP/M5250—01/2) **Making cents of your energy dollar. Volume 2. Technical materials and references.** (Energy Conservation and Alternatives Center for Commerce and Industry, Denver, CO (USA)). Jun 1979. Contract EM-78-G-01-5250. 142p. P 07/MF A01.

In Volume 1, the handbook's core is a logical sequence of steps for conducting energy audits and the implementation and monitoring of a comprehensive energy management program. Practical energy conservation opportunities, including simple, quick-fix, low-or-no-cost options (operational and maintenance - O and M) as well as selected capital intensive energy measures (retrofit and redesign) are indicated clearly in the easy-to-use Energy Audit Checklist. It should be noted that it is the primary responsibility of the energy auditor to identify energy saving opportunities. Management's responsibility is to follow-up on recommended O and M options. Model calculations are provided in Volume 2 for the majority of both types of conservation opportunities so that the management may compute potential savings and payback, using the results for intelligent decision making. These models have been standardized and programmed in such a way that it is possible to enter climatological data unique to particular heating and cooling zones. It must be emphasized that any energy calculation which treats building systems independently cannot give precise results.

51858 **Commercial buildings: retrofit and other energy opportunities and strategies.** Newman, J.H. (Tishman Construction & Research Co., Inc., New York, NY). pp 629-638 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Appreciating that there has been a lack of information to help make hard decisions relating to energy conservation in existing buildings, DOE funded a study to bring together sufficient information, in the office part of the commercial sector, to permit the proposal of a strategy for achieving more energy conservation in existing office buildings. Findings and recommendations that have emerged to date from this continuing study are summarized. Research for the study was based upon examination of 1030 office buildings containing about 250 million square feet of gross space in New York City. This is a substantial portion of the major office space in the city with the most office space in the world, and represents about 4% of the total office space inventory in the US. Diversity of building types, ages, and operating characteristics is very broad. A three-part cascading sampling methodology was developed and used, namely: (1) relatively little physical characteristic information was obtained for a large number of buildings, but enough data was gathered to be useful in establishing the general physical nature of the office building population and the representativeness of samples taken from it; (2) a relatively small representative sample was used with reasonable statistical confidence that it reflected the total office building population sampled in the first step; and (3) a still smaller sample was used reflecting the extremes and mid points of energy consumption of the second-step sample. As the size of the sample decreased, the amount of information obtained increased. It is believed that this is the first time this methodology has been used in energy studies. When compared with a random sampling method, it was found that random samples tend to be no more representative of the larger building population.

SCHOOL, MUNICIPAL AND OTHER PUBLIC BUILDINGS

REFER ALSO TO CITATION(S) 51856, 51857, 51861

51859 (AD-A—060552) **Energy monitoring and control systems effectiveness and efficiency. Master's thesis.** Alchian, A.A.; Burns, T.J. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Systems and Logistics). Sep 1978. 162p. Y A08/MF A01.

Energy Monitoring and Control Systems (EMCS) have been installed at numerous Air Force bases to reduce energy consumption and save operations and maintenance cost. However, Congress has been concerned with the actual results of the systems and is skeptical of the cost and savings estimates used to justify appropriation of funds for these systems. This study examines the effectiveness and efficiency of operational EMCS to determine if they meet current cost and energy savings criteria; determines if Architect-Engineer feasibility study cost and savings estimates used to justify the systems to Congress are accurate; and determines if there is an easier way than the detailed and costly feasibility studies to estimate the EMCS cost and savings. The study concludes that the current EMCS do meet the current cost and energy savings criteria and the Architect-Engineer feasibility study cost and savings estimates are accurate. The study did not find an easier way to estimate the EMCS cost and savings than the feasibility study method.

COMMERCIAL AND INDUSTRIAL BUILDINGS

REFER ALSO TO CITATION(S) 51798, 51856, 51858

51860 (CONF-7709114—, pp 21p, Paper 8) **Building energy analysis: manual vs. computerized.** Fisher, T.C. (Oak Ridge Y-12 Plant, TN). 1977.

From 3. ERDA energy management symposium; Knoxville, TN, USA (19 Sep 1977).

Three different methods for building energy analysis have been compared on the basis of predicted annual energy use, evaluation of design alternatives, and relative cost. Several types of buildings of varying size and complexity were examined and evaluated for potential savings derived from various conservation measures. The results suggest that the accuracy of available building data and the relative importance of the factors influencing a building's thermal load should be considered in selecting a calculation method. A balanced treatment of these factors in the calculation procedure is stressed.

51861 (COO—2820-1) **Jersey City energy conservation demonstration program. Final report.** Newbold, R.F. (Aerospace Corp., El Segundo, CA (USA). Energy and Resources Div.). Aug 1978. Contract EY-76-C-02-2820. 229p. (ATR—78(7584-01)-1). P 11/MF A01.

The Aerospace Corporation, the City Government, and the Board of Education of Jersey City have conducted a group of energy-conservation experiments to explore a number of conservation techniques believed to offer quick payback and to be of wide applicability. Experiments include the updating and/or rehabilitation of the energy-consuming features of old buildings and installation of devices designed to minimize energy losses caused by human error or laxity. Specific examples include: upgrading of the deteriorated and inefficient steam-distribution system of the city hall (originally constructed in 1894); an extensive program of reducing infiltration in an old school building; use of several timing devices in connection with heating, ventilation, and lighting systems to encourage energy-conservation practices; retrofit of school classrooms with high-pressure sodium lamps; and demonstration of practical and cost-effective ways of increasing the efficiency of conventional steam boilers. The report presents: the nature of the selected experiments; technical, human, and organizational factors that proved significant in performing and evaluating the experiments; discussions of observations and lessons learned; and general recommendations for an extended program of energy conservation in local governments. It is emphasized that, in retrofit of existing buildings, the unexpected is commonplace; and the habits and attitudes of building occupants are elements of the system that must always be taken into account. This report shows the benefits of energy saving, cost saving, and added comfort that may be attained by retrofitting old buildings, noting typical complications that arise. The effectiveness of the conservation methods is presented in terms of costs relative to effective payback periods calculated from results of their application in Jersey City.

51862 (DOE/TIC—10206) **Energy cost reduction for gasoline service stations.** (National Congress of Petroleum Retailers, Washington, DC (USA)). 12 Jul 1977. 25p. P 02/MF A01.

The handbook is provided to help gasoline service stations cut the cost of energy in their business establishments. It shows how to recognize and act on energy waste in interior and exterior lighting, space heating, and general station maintenance. Most of the energy use in gasoline stations is for lighting and heating. Lighting for interiors, storage areas, and general station exterior may consume from 30 to 70% of total energy costs. Heat and air conditioning costs make up most of the remaining energy outlay. A 15 to 25% cost reduction is possible by applying the recommendations in this handbook.

51863 (DOE/TIC—10207) **Energy cost reduction in retailing.** (American Retail Federation, Washington, DC). [nd]. 76p. P 05/MF A01.

The handbook was developed to help retail store owners cut the cost of energy in their businesses. It shows how to recognize and act on energy waste in interior and outdoor lighting, space heating, air conditioning and ventilation, general maintenance, warehousing, delivery, and refrigeration. Energy use in retail stores is significant because of the importance of environmental control, the role of lighting in merchandising, and long hours of operation. A 20 to 30% net cost reduction is possible by applying the recommendations in this handbook.

TRANSPORTATION

REFER ALSO TO CITATION(S) 51889

AIR AND AEROSPACE

51864 (AD-A—060477) **Aircraft engine future fuels and energy conservation. Lecture series.** (Advisory Group for Aerospace Re-

search and Development, 92 - Neuilly-sur-Seine (France)). Sep 1978. 189p. Y A09/MF A01.

Future fuel supplies for aviation is an important matter. If the world continues to consume its petroleum resources at its current rate of consumption, it will essentially run out of these resources by the turn of the century. The need for aircraft fuel conservation is most urgent, if not mandatory, because the future of aviation as we know it today, is at stake. This lecture series is designed to provide various interested members of NATO with a better understanding of the problems facing the aerospace community and to provide an opportunity to review and assess what steps can and are being taken to alleviate this international problem. Current and forecasted world energy demands, growth, and supply are reviewed in perspective to the status and outlook for future aviation fuels to meet NATO needs. The special problems associated with the refining of aviation fuels from lower quality feedstocks (including fuel refined from coal, oil shale, and tar sands) and techniques for reducing energy consumption in refining processes are examined. Special attention is given to the chemistry and combustion characteristics of future hydrocarbon fuels and the impact of using these fuels in aircraft engines and fuel systems. An assessment is made as to what technology advancements are underway and what other advancements are needed with reference to engine components, engine systems, aircraft designs and operational procedures to help conserve fuel resources.

LAND AND ROADWAY

REFER ALSO TO CITATION(S) 51885, 51984

51865 (DOE/CS—0096) **New approaches to successful vanpooling: five case studies.** (Department of Energy, Washington, DC (USA). Office of Conservation and Solar Applications). May 1979. 155p. P 08/MF A01.

This material provides a comprehensive summary of different approaches to successful low-cost vanpool operations in various areas of the U.S. It is designed to allow prospective vanpool sponsors to analyze and compare the methods used by those programs already in progress. Five programs described in detail are the New Jersey Vanpool Program, the Michigan State Employee Vanpool Program, Knoxville Commuter Pool, RIDES for Bay Area Commuters, Inc., and the Mason and Hanger - Silas Mason Co., Inc. Vanpool Program. Each summary contains a program description and a contact name.

INDUSTRY AND AGRICULTURE

REFER ALSO TO CITATION(S) 51783

51866 (ORNL/CON—29) **Economic-engineering energy-demand model for the pulp and paper industry. Phase I report.** Reister, D.B.; Chern, W.S.; Nguyen, H.D. (Oak Ridge National Lab., TN (USA)). Aug 1979. Contract W-7405-ENG-26. 76p. P 05/MF A01.

The first phase of a project to develop an economic-engineering energy demand model for the paper industry has been completed. The Phase I model has four components: (1) a paper demand submodel; (2) a pulp and paper process submodel; (3) a fuel-share submodel; and (4) an energy-conversion submodel. The report begins with a brief discussion of the structure and technology of the industry. After the details of the four submodels are presented, the results of the model are compared to historical data. The report concludes with a reference energy demand forecast, sensitivity analysis, and an analysis of the strengths and weaknesses of the model. Typical results for the Phase I model are as follows. Conservation causes the growth rates for all purchased fuels to be less than the growth rate for paper production. The demand for coal grows more rapidly than the demand for petroleum but petroleum remains the dominant purchased fuel. Demand for natural gas decreases but natural gas provides more energy than coal through 1990. Conservation of steam and an increased demand for electricity cause a decrease in the growth rate of electricity produced by cogeneration and an increase in the growth rate for purchased electricity.

51867 (ORNL/EIS—152) **Industrial Energy Use: a selected bibliography.** Ehrenshaft, A.R.; Barber, B.Y.; Carroll, P.J.; Fielden, J.M.; Plemons, L.K.; Weaver, R.S.; Nestor, S.W.; McDuffie, H.F. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 241p. P 11/MF A01.

The industrial and agricultural sectors account for approximately 40% of the total energy consumption in the United States. As a companion volume to the Industrial Energy Use Data Book, which will be published in the fall of 1979, this bibliography contains references dealing with the following energy-intensive industrial classifications: chemicals and allied products; primary metal industries; paper and allied products; stone, clay, glass, and concrete products; food and kindred products; construction; agriculture; fabricated metal products; transportation equipment; textile mill products; mining; machinery, except electrical; petroleum and coal products; and electric and electronic equipment. Also included are references on energy production, supplies, and reserves; the environmental impact of processing technologies; and government policies and legislation which affect end-use consumption. All references are keyworded and arranged alphabetically by author or by corporate author if individual authors are not cited in the document. Author, corporate author, sponsor, report number, keyword, and permuted title indices are provided.

ENERGY SOURCES

REFER ALSO TO CITATION(S) 50999, 51093, 51314, 51777, 51808, 51829

51868 (CONF-7709114—, pp 24p, Paper 6) **Alternate energy choices for plant studies.** Callahan, H.L. 1977.

From 3. ERDA energy management symposium; Knoxville, TN, USA (19 Sep 1977).

Characteristics, availability, and technology assessments are presented for 13 alternate energy choices. Coal and lignite, oil and gas, and the all electric system are considered for conventional energy systems. Under special situations, refuse derived fuels and energy recovery, purchased steam heat, coal gasification, nuclear, and heat pumps are considered. Energy alternatives for ocean power, geothermal development, dissolved methane energy sources, wind power, and solar power are site specific.

51869 (CONF-7906112—1) **Energy use quantification in the canning of Clingstone peaches.** Carroad, P.A.; Singh, R.P.; Chhinnan, M.S.; Jacob, N.L.; Rose, W.W. (Idaho National Engineering Lab., Idaho Falls (USA)). 1979. Contract EY-76-C-07-1570. 13p. P 02/MF A01.

From IFT meeting; St Louis, MO, USA (10 Jun 1979).

Thermal and electrical energy usages in a California Clingstone peach cannery were monitored to establish energy consumption levels and to identify energy intensive unit operations. Representative processing lines were instrumented with orifice plates for steam flow measurements and with electric watt transducers for electrical power monitoring to yield actual consumption values. Steam use in the lye peelers and retorts accounted for 98% of all energy consumed, indicating that further examination of these operations for modification or equipment redesign should be a first priority for energy conservation. Pumping of liquids and dry conveying of fruit and waste material accounted for 61% of all electrical energy use. Electrical energy use amounted to only 2% of the total energy used, however, on an equivalent fossil fuel use basis.

51870 (ORNL/TM—6872) **Comparison of two procedures for evaluating the economics of industrial power plants.** Sullivan, W.G. (Oak Ridge National Lab., TN (USA)). Aug 1979. Contract W-7405-ENG-26. 108p. P 06/MF A01.

This report compares two economic-evaluation procedures that are commonly used to evaluate engineering alaternatives for industrial power plants. the procedures are: discounted cash flow analysis (e.g., present worth and internal rate of return) and the revenue requirement method. The former procedure tends to be used by nonregulated, for-profit companies, while the latter is widely accepted in regulated utilities. Each analytical procedure is the same, namely, a conceptually sound assessment of economic differences among engineering projects such that the least-cost (or most profitable) project can be selected. It is demonstrated that the two procedures, when based on the same assumptions, produce the same preference rankings among alternatives being considered. In addition, the same incremental projected levelized cost streams are generated. Furthermore, it is shown that the effect of inflation and special tax incentives can be readily evaluated with both procedures and that identical results are obtained. For mutually exclusive alternatives, it is shown that the ratio of present worth of costs between the alternatives is identical to the ratio of levelized revenue requirements for selected debt-equity financing schemes. It is concluded that both methods of project evaluation provide consistent results in terms of relative economic differences among alternatives being considered. It should be noted that the quantification of economic differences (e.g., dollars per million Btu) among industrial power plants is not necessarily synonymous with estimating costs for the purpose of establishing a selling price for a commodity or service. This report centers on evaluation of after-tax economic differences among alternatives rather than development of estimates of a project's before-tax operating revenues that could be used, in turn, to formulate a firm's policy regarding energy prices.

MATERIALS

REFER ALSO TO CITATION(S) 51777

EQUIPMENT AND PROCESSES

REFER ALSO TO CITATION(S) 51019, 51020, 51021, 52329, 52330

51871 (BNL—26482) **Energy optimization of industrial energy use.** Pilati, D.A.; Sparrow, F.T. (Brookhaven National Lab., Upton, NY (USA); Purdue Univ., Lafayette, IN (USA)). 1979. Contract EY-76-C-02-0016. 7p. (CONF-791009—3). P 02/MF A01.

From International conference on energy use management; Los Angeles, CA, USA (22 Oct 1979).

The Brookhaven National Laboratory Industry Model Program (IMP) has undertaken development of a set of industry-specific process-optimization models. These models are to be used for energy-use projections, energy-policy analyses, and process-technology assessments. Applications of the models currently under development show that (1) system-wide energy impacts may be very different from engineering estimates, (2) selected conservation strategies may have the perverse effect of increasing energy use, and (3) a proper combination of energy taxes and investment tax credits is more socially desirable than either policy alone.

51872 (DOE/EIA—020016-1) **Iron and steel industry process model.** Sparrow, F.T. (Brookhaven National Lab., Upton, NY (USA)). Jul 1978. Contract EY-76-C-02-0016. 100p. P 05/MF A01.

The model depicts expected energy-consumption characteristics of the iron and steel industry and ancillary industries for the next 25 years by means of a process model of the major steps in steelmaking from ore mining and scrap recycling to the final finishing of carbon, alloy, and stainless steel into steel products such as structural steel, slabs, plates, tubes, and bars. Two plant types are modelled: fully integrated mills and minimills. User-determined inputs into the model are: (a) projected energy materials prices for the horizon; (b) projected costs of capacity expansion and replacement; (c) energy conserving options - both operating modes and investments; (d) internal rate of return required on projects; and (e) growth in finished steel demand. Nominal input choices in the model are: DOE baseline projections for oil, gas, distillates, residuals, and electricity for energy, and 1975 actual prices for materials; actual 1975 costs; adding new technologies; 15% after taxes; and 1975 actual demand with 1.5% growth/year. Output of the model includes: energy use by type, by process, and by time period, both in total and intensity (Btu/ton); energy-conservation options chosen; and utilization rates for existing capacity, and the capacity expansion decisions of the model.

51873 **Fiftieth annual meeting of the Minnesota Section, AIME; thirty-eighth annual mining symposium.** Graven, L.K. (comp.). Minneapolis, MN; Univ. of Minnesota (1977). 463p. (CONF-770162—).

From 38. mining symposium; Duluth, MN, USA (12 Jan 1977).

Proceedings contain one keynote address and 22 papers, most of them centered around the overall theme, The World of Iron Ore. Specific subjects include: PUROFER - direct reduction tuned to steel plant requirements; alternate fuels for the Fior direct reduction process; selective flocculation—flotation of Western Mesabi oxidized taconite; uranium in situ leaching - its advantages, practice, problems and computer simulation; sublevel stoping at Pilot Knob Mine; application of coal gasification for the production of iron ore pellets; mitigation of dust from taconite tailings. Nine selected papers have been entered individually into EDB and ERA.

51874 **Study of coal firing in the GRATE—KILN System.** Faulkner, B.P.; Losin, E.T.; Cnare, R.F. pp 18.1-18.29 of Fiftieth annual meeting of the Minnesota Section, AIME; thirty-eighth annual mining symposium. Graven, L.K. (comp.). Minneapolis, MN; Univ. of Minnesota (1977).

From 38. mining symposium; Duluth, MN, USA (12 Jan 1977).

The GRATE—KILN System utilizes a multiple pass grate to dry and preliminarily indurate a bed of agglomerated mineral fines, and a rotary kiln for final, high temperature, induration, and finally a multi-stage recuperative cooler. The principal source of heat for the process is supplied by a burner mounted in a firing hood at the kiln discharge end. The burner fires centrally through the kiln. Rotary kilns have been applied to many pyroprocesses for decades; they have been fired successfully with a variety of fuels ranging from combustible gases to all grades of fuel oils, lignites and coals. This paper will discuss the utilization of coal in GRATE—KILN Systems used for iron ore pelletizing. The most common fuel used for pelletizing in North America is natural gas; it is heavy residual fuel oil in foreign operations. The use of natural gas for industrial processes in the United States is being heavily curtailed; furthermore, the price and availability of petroleum products are subject to foreign influence. Pellet plant operators and equipment suppliers are, therefore, heavily investing in the development of technology to utilize the most available source of domestic energy - coal. It is most significant that this technological development is not being confined to laboratories and pilot plants. Commitments have been and are being made to purchase the equipment necessary to fire coal in approximately 29 pelletizing lines with a full understanding that much will have to be learned when commercial-scale coal firing is put into practice.

WASTE HEAT RECOVERY AND UTILIZATION

REFER ALSO TO CITATION(S) 51541, 51792

51875 (CONF-7709114—, pp 22p, Paper 2) **Energy economizer for low-temperature stack gas: a case study.** Tipton, J.A.; Hagenhoff, R.S.; Hughes, K.J. (Energy Research and Development Administration, Bartlesville, OK). 1977.

From 3. ERDA energy management symposium; Knoxville, TN, USA (19 Sep 1977).

A conservation project was initiated to investigate the feasibility of installing an air preheater on one of the hot water generators at the Bartlesville (Oklahoma) Energy Research Center (BERC). Contingent upon favorable economics and the successful resolution of technical details, the second phase of the project consisted of final design and installation of the equipment. A new stack assembly to accommodate an air preheater system was designed by BERC engineers and fabricated at a commercial metal shop. Installation of this assembly was completed by BERC maintenance personnel. Total direct cost for ductwork, heat exchanger, and new stack was $7,562. Initial results show a significant reduction of about 7% in fuel consumption at all operating ranges. At full-load conditions, incoming combustion air is preheated to 250°F above ambient temperature. No adverse corrosive effects have been observed after about 6 months. BERC management is optimistic that a general application of this concept can contribute to many conservation programs.

51876 (STU—76-5419(Pt.3)) **Energy conservation in iron- and steel-industry: a basis for planning of R and D.** Hardell, R.; Fors, J.; Raab, A. (Styrelsen foer Teknisk Utveckling, Stockholm (Sweden)). 3 Mar 1978. 63p. (In Swedish). U 03/MF A01.

The steel industry consumes about 20% of the total energy used in Sweden. It is estimated that about 35% of the energy used by the steel industry goes into the metallurgical reactions, which leaves a huge potential for conservation and recovery. The different types of furnaces, their energy consumption and their potential for energy recovery are reviewed. The economics of process heat recovery is briefly discussed.

INDUSTRIAL WASTE MANAGEMENT

REFER ALSO TO CITATION(S) 51046, 51047, 51048, 51049, 51050, 51051, 51052, 52227

51877 (TID—29305) **Development of potential uses for the residue from fluidized bed combustion processes. Quarterly technical progress report, September—November 1978.** Minnick, L.J. (Minnick (L.J.), Inc., Plymouth Meeting, PA (USA)). 1978. Contract EF-77-C-01-2549. 24p. P 02/MF A01.

Results of x-ray diffraction analysis of an AFB residue sample from Combustion Engineering in Windsor, Connecticut reveals the presence of a high percentage of calcium carbonate in this source of spent bed residue. The particle size distribution of this material is identical to that of a spent bed residue sample from Alliance, Ohio. Initial evaluation of lime separation of AFB residue from Alliance, Ohio by means of a soil elutriator indicate limited value for this technique as a sole means of lime extraction; however, the elutriation system may be useful when employed in conjunction with other beneficiation techniques. Use of an x-ray hydration procedure is seen as an efficient means of identifying basic differences in the rate of hydration of different AFB residue sources. The results of a study of dimensional stability of cylindrical stabilized base specimens containing AFB residue indicate clearly that the majority of the volume expansion noted in the specimens occurs during initial curing within a 7 day period following the molding of the specimen. Early 7 day strength results from a comprehensive road base mix design study have indicated that excellent strength can be established in a number of formulae which were considered for a road demonstration. The experience gained from a recent field demonstration project in eastern Ohio proves that, with proper moisture control, stabilized road base compositions containing varying amounts of AFB residue can be successfully blended and placed in the field using conventional mixing, spreading, and compaction equipment. A recently completed demonstration of the use of AFB residue as a sorbent medium in a flue gas desulfurization system at Southern Illinois University has shown that the system operated with AFB residue in much the same manner as with commercial hydrated lime.

51878 **Bark burning system.** Jasper, M.J.; Koch, P. US Patent 4,105,397. 8 Aug 1978. Filed date 10 Jan 1977. 5p.

This invention relates to the utilization of by-products and wastes from sawmills as a source of heat or power for such mills.

Green bark particles are conveyed slowly downward through a drying chamber countercurrently to rising hot combustion gases in a surrounding annular combustion zone. Bark discharges from the bottom of the drying chamber as fuel into the combustion zone.

51879 Industrial wastes to energy. Collins, J.F. pp 804-807 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

An overview is presented of the present scope of Federal research programs at the Department of Energy utilize industrial wastes. The present program consists of two classes of projects with a FY 1978 budget level of $5.2 million (analytic and materials or processes development including industrial wastes utilization). Five analytic projects cover: energy-economic modeling, and materials systems modeling and data establishment. These five are supportive of the other approximately 20 materials-process projects and also serve programs throughout the Division of Industrial Energy Conservation. The industrial wastes-to-energy development program is typified by 4 projects described: chemicals production from waste carbon monoxide; fuels production from waste polypropylene; conversion of waste cellulose and polymer materials to gasoline; and protein and energy production from sulfite pulp wastes. A number of other wastes utilization projects are also underway. These include: waste paper pulp characterization by automated means; re-refining waste motor oil; use of slags and fly ash as cement components; and solvent extractive drying of paper pulp sludge for boiler fuel use. The top energy-counsuming industries are identified as steel, chemicals, petroleum refining, paper, food production and processing, aluminum, cement, textiles, and gas. (MCW)

MUNICIPALITIES AND COMMUNITY SYSTEMS

51880 (STUDSVIK/ES—78/81) **Hyro-powered heat pumps: a pilot study.** Ernstson, G. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 14 Jun 1978. 101p. (In Swedish). U 06/MF A01.

An economic and technical estimation of the conditions for hydro-powered heat pumps, i.e., using hydraulic turbines to drive heat pump compressors, is given. Possible locations for such plants for district heating are also discussed.

PUBLIC UTILITIES

REFER ALSO TO CITATION(S) 51421, 51792

51881 Overview of utility involvement with dual energy use systems. Dougherty, D.A. (Electric Power Research Inst., Palo Alto, CA). pp 832-846 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Cogeneration has become a household word outside the utility industry, where it has been well known for many years. Familiarity with the word, however, does not imply knowledge of the details of the concept or an ability to objectively evaluate its potential. There exists a critical need to bring together the various people and institutions with strong interests and experience in this area to develop a resource base of information for each of the options which could in principle produce useful thermal and electrical energy from a common source. Results of a week-long workshop designed to allow input from each institutional interest (e.g., industrial and other consumer experts, government representatives, utility personnel, academicians, and equipment manufacturers) are summarized. Case examples of various utility DEUS projects are presented along with discussion of the various technical problems and economic issues associated with such systems.

51882 Utilization of low-temperature waste heat from power plants. Maulbetsch, J.S. (Electric Power Research Inst., Palo Alto, CA). pp 847-853 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

The potential for utilization of reject heat from steam-electric power plants is reviewed. The characteristics of the resource and the requirement are compared on the basis of quantity of energy, temperature level, spatial and temporal distribution, and cost-revenue ratios. District heating and aquaculture are identified as the only potentially viable applications.

51883 Use of conventional technology and potential for emerging technologies in cogeneration. Neal, J.W. pp 948-959 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

Cogeneration has long been used to provide both electric and thermal energy to meet on-site needs. In 1950, cogeneration provided over 15% of the nation's electric energy. After 1950, the use of cogeneration declined, so that today it accounts for only 4% of our electric energy. In the past few years, cogeneration has again emerged as an attractive and important energy conservation system. This paper describes the reasons for this renewed interest, the technical limitations of such representative current technologies as steam-turbine topping cycles, gas-turbine topping cycles, and diesel-engine topping cycles and the need for new technologies. It concludes with a summary of what the Department of Energy is doing to enhance the potential of advanced cogeneration technologies.

EDUCATION AND PUBLIC RELATIONS

REFER ALSO TO CITATION(S) 51852

ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

INTERNAL COMBUSTION ENGINES

51884 (LBL—9423) **Hybrid random choice method with application to internal combustion engines II.** Sod, G.A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1979. Contract W-7405-ENG-48. 19p. (CONF-790840—1). P 02/MF A01.

From 6. international symposium on combustion processes; Karpacz, Poland (26 Aug 1979).

A numerical procedure was introduced for solving one-dimensional equations of gas dynamics for a cylindrically or spherically symmetric flow. This method has been generalized to the two-dimensional equations of gas dynamics in a cylindrical geometry. This is coupled at the boundary with a new grid free method for introducing viscous effects, where the computational elements are segments of vortex sheets and circular vortex filaments. Examples are given for flow in a motored engine chamber during intake and compression strokes.

51885 (PB—288224) **A compilation of steady state automotive engine test data. Final report, June 1976—May 1978.** Kidd, J.A. Jr.; Colello, R.G. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Sep 1978. 273p. Y A12/MF A01.

Experimental data were obtained in dynamometer tests of automotive engines used in the United States. The objective of this program is to obtain engine performance data for determining fuel consumption and emissions (carbon monoxide, hydrocarbons, and oxides of nitrogen) at steady-state engine operation modes. Each engine was tested over its entire speed/load operating range. The test results proved to have sufficient repeatability to establish steady-state maps for fuel consumption and emissions over the entire operating range of the engine. These data are useful for estimation of fuel economy and emissions for engineering calculations involving ground transportation.

DIESEL

REFER ALSO TO CITATION(S) 51891

TURBINE

51886 (COO—4867-03) **Gas turbines engines and transmissions for bus demonstration programs.** Nigro, D.N. (Energy Research and Development Administration, Pittsburgh, PA (USA). Pittsburgh Energy Research Center). Apr 1979. EM-78-C-02-4867. 6p. P 02/MF A01.

The technical status report fulfills the contractual requirements of Contract EM-78-C-02-4867. The report covers the period from 31 January 1979 through 30 April 1979 and is a summary of DDA activities for the effort performed on the procurement of eleven (11) Allison GT 404-4 gas turbine engines and five (5) HT740CT and siz (6) V730CT Allison automatic transmissions and the required associated software. (TFD)

EXTERNAL COMBUSTION ENGINES

STIRLING CYCLE

51887 (DOE/NASA/0032—79/1) **Conceptual design study of an automotive Stirling reference engine system.** (Mechanical Technology, Inc., Latham, NY (USA)). Jun 1979. Contract EC-77-A-31-1040. 31p. (NASA-CR—159605). P 03/MF A01.

An early task under the contract requires the contractor to prepare a series of conceptual Stirling engine system designs intended to meet the final program objectives, and to submit the initial conceptual designs, supporting analyses and recommendations to the NASA Project Manager for review and approval. The recommended Stirling engine concept should be the one which has the greatest chance of successfully meeting the final program objectives, within the capabilities, schedule and budget of the Program. The report summarizes the studies that were made, the methodology that was used and the results which support the concluded recommendation of a: Four cylinder, double acting, and square U design, with external regenerators. Optimization of this design concept resulted in a calculated fuel economy of 36.3 mpg for a 3200 pound vehicle, compared to the program goal of 30.0 mpg., and acceleration time of 13.1 seconds compared to the program goal of 15.0 seconds. The engine will meet or exceed the program emission goals of HC < 0.41 gram/mile, CO < 3.4 gram/mile, and NO/sub x/ < 0.4 gram/mile.

ELECTRIC-POWERED SYSTEMS

REFER ALSO TO CITATION(S) 51890

51888 (SAN—1180-1) **Prospects for electric cars: electric vehicle impact assessment study. Final report, 15 December 1975—30 April 1978.** Hamilton, W. (General Research Corp., Santa Barbara, CA (USA)). Nov 1978. Contract EY-76-C-03-1180. 487p. P 21/MF A01.

The characteristics of future electric cars were projected by means of parametric models of weight, cost, and performance. They included urban ranges as much as two to four times those of recent electric cars: up to 150 km for improved lead-acid batteries, 250 km for nickel-zinc batteries, and 450 km for lithium-sulfur batteries. From data tapes of major travel surveys in Los Angeles and Washington, these ranges were found to be sufficient for most needs of all three major groups of drivers: secondary and primary drivers at multi-driper households, and drivers at one-driver households. Even with the longest design ranges, however, the electric cars would be incapable of occasional long trips now made by conventional cars, and only at the shortest design ranges would they be competitive in cost. Through modeling of supply and demand for over 200 U.S. utilities it was projected that, by the year 2000, almost 60% of US cars could be electrified, only 17% of the recharging power would come from petroleum. Modeling of air pollutant emissions for 24 large urban regions showed that electrification of all cars would reduce regional hydrocarbons and carbon monoxide emissions by roughly half, but increase sulfur oxide emissions some 20%. Traffic noise would be significantly reduced, even after major quieting of conventional vehicles. Identified resources of battery materials suffice for tens of millions of electric cars, but not necessarily for complete electrification of all US autos. Economic impacts aside from added costs for motorists would be relatively minor.

51889 **Flywheels for vehicles.** Mason, J.L. (Garret Corp., Los Angeles, CA). Contract EY-76-C-03-1213. pp 167-175 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

This paper describes recent progress in the development of an advanced, composite-material flywheel for future use in a small, battery-powered electric commuter vehicle. This work is being conducted by the AirResearch Manufacturing Company of California. This contract is for the design, development, and demonstration of an integrated test vehicle powered by lead/acid batteries as the primary energy source and augmented by a new, lightweight, composite-material flywheel, which is used to supply the peak power demands during stop-and-go city driving and to store the energy recovered during regenerative braking. The paper describes the selected flywheel design and some of the more important performance characteristics and advantages. The required high-vacuum environment for the high-speed flywheel also is described. The current status of the development is discussed and test results are presented.

HYBRID SYSTEMS

51890 (UCRL—52758) **Impact of flywheel-transmissions on automobile performance: a logical basis for evaluation.** McAlevy, R.F. III. (McAlvey (Robert F. III) and Associates, Hoboken, NJ (USA)). 9 Apr 1979. Contract W-7405-ENG-48. 33p. P 03/MF A01.

The study deals with the application of flywheel-transmissions to electric vehicles and to petroleum-fueled automobiles. In contrast with previous work in this area, which was based on a variety of computer models of automotive vehicles, an analytical approach was taken. The intention was to evolve simple algebraic equations that describe an automobile's total (laden) mass and energy economy as a function of mission requirements (i.e., payload, range, and drive-cycle acceleration demand). Equations are given that can be used to evaluate the impact of a flywheel-transmission on an automobile's mass and energy economy.

51891 (UCRL-Trans—11482) **Hydro bus: development of a prototype with optimized hybrid propulsion.** Willumeit; Korkmaz. (Bundesministerium fuer Forschung und Technologie, Bonn-Bad Godesberg (Germany, F.R.)). Apr 1979. Translated from Nahverkehrsforschung '78 (research on short-distance traffic 1978), pp 225-231. 17p. P 02/MF A01.

The conceptional design for a city bus powered by a diesel engine and equipped with hydraulic accumulators is presented. Projected performance and fuel consumption for the bus are discussed. (TFD)

FLYWHEEL PROPULSION

REFER ALSO TO CITATION(S) 51889

51892 (UCRL—15045) **Application of inertia welding technology to steel disc-type flywheels. Final report.** (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). 29 Jun 1979. Contract W-7405-ENG-48. 80p. P 05/MF A01.

The program was established to investigate the feasibility of applying inertia welding to the fabrication of steel flywheel assemblies for transportation application. In the inertia welding process, the weld is accomplished by friction and pressure. The parts are literally spun together. The inertia welding characteristics of three steel alloys (Hy-Tuf, 4340, and D6AC) were determined by welding both solid bars (1-in. OD) and tubular specimens (2-in. OD by 0.1-in.-thick wall). In addition, characteristics of the weld and the weld flash (that material extruded from the weld mating surfaces during the welding process) were evaluated. Results indicated Hy-Tuf and 4340 have good welding characteristics, while D6AC is questionable. (TFD)

NITROGEN OXIDES

REFER ALSO TO CITATION(S) 51893

ALTERNATIVE FUELS

REFER ALSO TO CITATION(S) 51201, 51202

51893 (CONF-790520—3) **Evaluation of methanol for reduced exhaust emissions in a single-cylinder research engine.** Samaga, B.S.; Gopala Krishnan, K.V.; Murthy, B.S.; Pefley, R.K.; Bechtold, R.L.; Edwards, G.W. (Karnatak Univ., Dharwar (India); Indian Inst. of Tech., Bombay; Santa Clara Univ., CA (USA); Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). 1979. 12p. P 02/MF A01.

From 3. international alcohol fuels technology; Asilomar, CA, USA (28 May 1979).

The investigation examines the influence of different operating parameters on the formation of oxides of nitrogen, carbon monoxide, unburned fuel and the aldehydes when fueled by methanol and methanol-water mixtures. Also, the effect of adding small quantities of aniline on the burning rate and aldehydes exhaust has been explored.

51894 (CONF-790520—4) **Physical properties of gasoline/alcohol automotive fuels.** Cox, F.W. (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). 1979. 14p. P 02/MF A01.

From 3. international alcohol fuels technology; Asilomar, CA, USA (28 May 1979).

Non-petroleum derived alcohols are likely candidates for near-future use as alternative automotive fuels. Low molecular weight alcohols may be used alone or in combination with gasoline, but either usage presents its own unique set of advantages and disadvantages. This report addresses the physical property changes

(both beneficial and detrimental) which occur when alcohols are added to gasoline as fuel extenders. The experimental data and discussion of results cover four physical property areas: water tolerance, vapor pressure, distillation characteristics, and octane quality. The alcohols include methanol, ethanol, n-propanol, i-butanol, and synthetic methyl fuel. Several additional alcohols were tested, but only as gasoline/methanol cosolvents. The major objective of the physical properties study was to determine the interdependency among the variables which are responsible for the significant property changes so that, where possible, gasoline/alcohol properties can be estimated from blend composition. Trends are also discussed in terms of the general influences of system variables.

51895 (CONF-790520—6) **50,000 mile methanol/gasoline blend fleet study: a progress report.** Stamper, K.R. (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). 1979. 14p. P 02/MF A01.

From 3. international alcohol fuels technology; Asilomar, CA, USA (28 May 1979).

Seven current production automobiles are being used in a fleet study to obtain operational experience in using 10% methanol/90% gasoline blends as an automotive fuel. Data from chassis dynamometer tests (run according to the 1975—1978 Federal test procedure) have been obtained, showing fuel economy and exhaust emissions of carbon monoxide, oxides of nitrogen, unburned fuel, methanol, and aldehydes. These data are shown for each of the vehicles when operated on the 10% methanol blend, and on unleaded low octane Indolene. Chassis dynamometer tests were run at 5,000-mile intervals during the 35,000 miles accumulated on each of the four 1977 model-year vehicles and at 5,000 and 10,000 mile accumulation levels for each of the three 1978 model-year vehicles. These data show an average decrease in volumetric fuel economy (≅ 5%) and a reduction in carbon monoxide emissions associated with the use of the 10% methanol blend. Exhaust emission deterioration factors are projected from the Federal test procedure urban cycle data. The most severe driveability problems that have been encountered thus far into the program are related to operating on a phase separated fuel and materials compatibility problems with an elastomer in the air-fuel control hardware of one vehicle.

51896 (CONF-790520—7) **Driving cycle comparisons of energy economies and emissions from an alcohol and gasoline fueled vehicle.** Bechtold, R.; Pullman, B. (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center; Santa Clara Univ., CA (USA)). 1979. 13p. P 02/MF A01.

From 3. international alcohol fuels technology; Asilomar, CA, USA (28 May 1979).

A late-model vehicle was converted to operate using methanol, gasoline, or ethanol as fuel and experimental work was done to obtain energy economy and exhaust emissions data for each of the three fuels. Results are compared at equal equivalence ratios both with and without an oxidation catalyst in the exhaust system. Using a catalyst for emissions control, unburned hydrocarbon emissions were lowest during lean operating conditions and were nearly the same for all three fuels under those conditions. Oxides of nitrogen emissions typically were reduced by over 50% in changing from gasoline to methanol or ethanol. Detailed composition of the exhaust hydrocarbons was determined from analysis via gas chromatography. These data were used for calculating photochemical reactivities and comparisons were made among the fuels during cold start and FTP weighted tests. Gasoline exhaust was often calculated to have the lowest total reactivity during the FTP, however, methanol exhaust reactivity was lowest for the stoichiometric condition with catalyst. Aldehydes accounted for large fractions of the reactivity calculated for methanol and ethanol exhausts. Cold start emissions were of about equal reactivity for gasoline and methanol.

MATERIALS

REFER ALSO TO CITATION(S) 50928, 52086

51897 (CONF-790657—1) **Toward a comprehensive theory of radiation-induced swelling and creep - the point defect concentrations.** Mansur, L.K.; Yoo, M.H. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 8p. P 02/MF A01.

From Conference on irradiation behavior of metallic materials for fast reactor core components; Corsica, France (5 Jun 1979).

The theory of void swelling and irradiation creep is now fairly comprehensive. A unifying concept on which most of this understanding rests is that of the rate theory point defect concentrations. Several basic aspects of this unifying conept are reviewed. These relate to local fluctuations in point defect concentrations produced by cascades, the effects of thermal and radiation-produced divacancies, and the effects of point defect trapping.

51898 (COO—4237-3) **Systems analysis for materials optimization. Technical report for 1979.** Berry, R.S. (Chicago Univ., IL (USA)). 1979. Contract EC-77-S-02-4237. 3p. P 02/MF A01.

A brief summary of the research program at the University of Chicago on system analysis for materials optimization is presented. (FS)

51899 **High-pressure science and technology. Volume 1. Physical properties and material synthesis.** Timmerhaus, K.D.; Barber, M.S. (eds.). Contract ER-78-C-02-4618. New York, NY; Plenum Press (1979). 1078p. (COO—4618-(Vol.1); CONF-770706—P1).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Separate abstracts have been prepared for items within the scope of the energy data base. (FS)

51900 **Materials problems in solar and nuclear energy and storage of energy.** Claassen, R.S. (Sandia Labs., Albuquerque, NM). *SAMPE Q.*; **10**: No. 1, 27-35(Oct 1978).

From 5. energy technology conference; Washington, DC, USA (Feb 1978).

Typical examples are provided to illustrate the intimate relationship of materials and processing to the energy program. Developing energy technologies place increasing demand on material performance and in some cases exceed known material capabilities. Material choices in solar systems are dominated by cost; distributed collectors and the central receiver illustrate practical problems. The demand for absolute safety in nuclear power requires a depth of understanding and level of knowledge about materials unachieved in previous engineering systems; problems in water-cooled and breeder reactors emphasize the point. Fusion reactors will push far beyond our present knowledge of material response and behavior. Within limits, energy storage is practical today but present technologies such as batteries are being pushed hard and new schemes such as superconducting solenoids and thermochemical storage are under intense study.

METALS AND ALLOYS

REFER ALSO TO CITATION(S) 50929, 50976

PREPARATION AND FABRICATION

REFER ALSO TO CITATION(S) 51918, 51941

51901 (DOE/ET—0058/5, pp 70-78) **Status of Path B Base Research Alloy procurement and fabrication.** Roche, T.K. (Oak Ridge National Lab., TN). 1979.

In Alloy development for irradiation performance. Quarterly progress report for period ending March 31, 1979.

Two 140-kg heats of each of five high-nickel alloys were double vacuum melted and hot rolled into bar stock. Some of each alloy has been received and extruded into round and sheet bar. Part of the sheet bar of each alloy has been processed to 1.27 and 0.61-mm (0.050 and 0.024-in.) sheet.

51902 (DOE/TIC—10200) **[Development of automated welding process for field fabrication of thick walled pressure vessels: management plan]. Technical progress report for period ending March 31, 1979.** (Westinghouse Electric Corp., Tampa, FL (USA). Tampa Div.). 10 Apr 1979. Contract EF-78-C-01-2771. 12p. P 02/MF A01.

Activities accomplished during this period included reviews of gas metal-arc, gas tungsten-arc, submerged arc, and electron beam welding processes. The prototype torch was designed and built and seam tracker probes were demonstrated. (FS)

51903 (EUR—5792) **Thermal desorption (outgassing) of Inconel.** Reiter, F.W.; Camposilvan, J. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1977. 74p. U 05/MF A01.

The quantity and the composition of gas released from Inconel 600 samples after different methods of surface preparation have been measured during a heating cycle to a temperature of 500°C. After this first outgassing cycle the specimens were exposed to dry air and nitrogen, and the quantity and the composition of the re-adsorbed gas have been determined during a similar heating cycle. The results of these measurements are important for the mechanical and thermal pre-treatment of the vacuum wall surface of fusion devices using Inconel 600 as the vacuum wall material.

51904 (TREE—1364) **Welding technology development. Quarterly progress report, January—March 1979.** Smartt, H.B.; Wallace, U.S.; Turner, P.W. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1979. Contract EY-76-C-07-1570. 15p. AT.

Progress on a DOE-RRT-funded Welding Technology Development Program is described. Welding was initiated on 0.71-m (28-in.) diameter Schedule 40S pipe to be used in a thermal aging

study. Results of a study involving manual grinding of J-bevels for narrow-groove welds are presented. Maintenance and calibration of mechanized welding equipment performed during the quarter are also mentioned.

51905 (UCRL—15035) **Project vulcan heater: centerbody casting.** (Casting Consultants Co., Castro Valley, CA (USA)). 11 Jun 1979. Contract W-7405-ENG-48. 10p. P 02/MF A01.

Specifications for casting the centerbody housing of the vulcan heater are provided. CD-4MCu steel has been specified for the centerbody and the properties of the steel are given. (FS)

51906 Nickel—chromium alloy submerged arc weld surfacing using metal powder filler additions. Reynolds, G.H. (Materials Sciences Northwest, Corvallis, OR). *Nucl. Technol.;* **43**: No. 3, 388-390(May 1979).

We developed a technique for producing nickel—chromium weld overlay claddings at increased metal deposition rates. Addition of supplemental filler metal in the form of atomized powder to the submerged arc surfacing process increases the total metal deposition rate in proportion to the amount of metal powder added. Deposit chemistry, microstructure, and integrity are similar to those produced by conventional, oscillated electrode submerged arc cladding operations.

51907 Synthesis of A15-type materials at high pressures: comments and critiques. Webb, A.W.; Francavilla, T.L.; Meussner, R.A. (Naval Research Lab., Washington, DC); Waterstrat, R.M. pp 297-308 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Materials with the A15 structure are of interest because a number of them are superconductors. Synthesis of Nb—Si, Nb—As, Nb—Al, and Nb—Ge was studied. A15 phases of Nb—Si and Nb—As were attempted and it was found that the Ti_3P phase was stable up to pressure of 6 GPa and temperature of 1800° and 2200°C respectively. In Nb—Si oxygen contamination favored the bcc Nb solid-solution structure. Nb—Al and Nb—Ge were found to be similar in that both are peritectic at ambient pressure. The pressure effect of Nb—Al is slightly negative. (FS)

51908 Hot isostatic processing. Hanes, H.D. (Battelle Columbus Labs., OH). pp 633-650 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Hot Isostatic Processing (HIP) is a fuel element fabrication technique. The HIP process was used to fabricate several experimental core loadings of fuel elements. As outgrowth of these activities, HIP was also used to consolidate powders into complex shapes. These early activities were initiated to consolidate difficult to fabricate materials such as nuclear fuels into useful shapes. Later, the work was extended to materials which were characterized by being expensive, difficult to fabricate, and of a relatively low volume. Since the early HIP equipment was limited to relatively small-volume capabilities, it placed constraints on the possible uses for the process at that time. A significant step forward in the development of the HIP process was made with the evolution of advanced designs for HIP furnaces. The furnace developed at Battelle occupied a relatively large volume of the pressure vessel with a stable hot zone. For the first time, it was demonstrated that large HIP work spaces were possible, so that larger components could be contemplated. This demonstrates that HIP is a current production process, that HIP is a practical, cost-effective method of applying high-pressure technology to the metalworking industry; to highlight the net-shape-making capability of the HIP process; and to stress primarily the generic mechanical/metallurgical effects of the HIP process and how this process can be advantageous as compared to other metal-working processes.

51909 Development and operation of a large hot isostatic pressing system. Boyer, C.B.; Woessner, D.S.; Rhodes, T.C. (Battelle Columbus Labs., OH). pp 664-678 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Hot-isostatic-pressing is the simultaneous application of heat and gas pressure to a body to perform useful work. The first application for hot isostatic pressing was the isostatic diffusion bonding of nuclear components. The major applications of this process are in the areas of powder consolidation, upgrading of the properties of cast materials, improvement of the properties of carbide materials, high pressure impregnation, and high pressure carbonization in addition to isostatic—diffusion bonding. Experiences in the development of this large system for pilot production applications are revised. Over the past 29-month period since its first successful cycle, over 145 developmental cycles have been performed with specimen loadings in excess of 12,000 pounds (5400 kg).

51910 Future trends in high pressure—high temperature synthesis of superconducting materials. Skelton, E.F.; Webb, A.W. (Naval Research Lab., Washington, DC). pp 960-973 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Over the past ten years, more than 150 studies have been published in the field of high pressure synthesis spanning an even wider range of materials. Discussion is restricted to those high pressure—high temperature (HP—HT) synthesis efforts which are specifically addressed to superconducting materials. In an effort to suggest future trends, published work in this area over the past decade was reviewed. Recent efforts to synthesize new superconductors are summarized. Some of the shortcomings of current synthesis efforts are delineated, followed by suggestions to improve future work in this field. The new NRL high press—high temperature synthesis facility which is designed to correct several existing synthesis problems will be discussed.

51911 Thermodynamics of A15 compound formation by diffusion from ternary bronzes. Dew-Hughes, D.; Luhman, T.S. (Brookhaven National Lab., Upton, NY (USA)). *J. Mater. Sci.;* **13**: No. 9, 1868-1876(Sep 1978).

The formation of high Tsub(c)Nb_3Al, Nb_3Ga, Nb_3Ge and V_3 (Ga, Si) has been attempted by solid state diffusion from ternary bronzes. None of the desired compounds were formed. The results are explained in terms of the thermodynamics of compound formation by solid state diffusion. Diffusion follows two-phase tie-lines; only those phases which lie on tie-line routes, and which are the most stable as defined by the stability index, are able to form. The addition of the third element to the bronze in general has little significant effect. There is no evidence to indicate that high Tsub(c)Nb_3Al, Nb_3Ga or Nb_3Ge can be produced by solid state reaction.

STRUCTURE AND PHASE STUDIES

REFER ALSO TO CITATION(S) 51932, 51935, 51956, 52034

51912 (COO—4246-8) **Microstructural effects in abrasive wear. Quarterly progress report, December 15, 1978—March 15, 1979.** Fiore, N.F.; Kosel, T.H.; Konkel, W.; Fulcher, J. (Notre Dame Univ., IN (USA). Dept. of Metallurgical Engineering and Materials Science). 15 Apr 1979. Contract EF-77-S-02-4246. 44p. P 03/MF A01.

An understanding is sought of the relationships between low-stress and gouging wear resistance and microstructure of a series of Ni—Cr white irons and Co-base powder metallurgy (PM) alloys. Time wear testing, optical and quantitative metallography (QTM), and scanning electron microscopy (SEM) have been completed. The wear-microstructure interactions of Ni—Cr iron (Ni-Hard 4) samples having various volume fractions of retained austenite are discussed. The results of detailed SEM studies are considered along with micro-quantitative analyses of the wear scars by energy-dispersive x-ray spectroscopy (EDXS), to provide interpretation of the wear behavior in terms of material removal micro-mechanisms in the white irons.

51913 (HEDL-SA—1689) **Martensitic transformation in high magnetic fields.** Korenko, M.K.; Cohen, M. (Massachusetts Inst. of Tech., Cambridge (USA); Westinghouse Hanford Co., Richland, WA (USA)). Apr 1979. Contract EY-76-C-14-2170. 7p. (CONF-7906116—1). P 02/MF A01.

From ICOMAT-79 conference; Cambridge, MA, USA (Jun 1979).

The kinetics of the isothermal martensitic transformation in Fe—29.6 Ni and Fe—22.5 Ni—4 Mn alloys were investigated as a function of constant magnetic fields, ranging up to 140 KOe (11 x 10^6 ampere/m). The principal role of the applied magnetic field is to increase the free-energy difference between the product and parent phases in these iron-based alloys, and so the transformational driving force for a given composition can be varied even at a fixed temperature. In the Fe—Ni alloy, the isothermal transformation rate is increased by raising the magnetic field as well as by lowering the temperature, leading in either case to the entre of burst characteristics. The Fe—Ni—Mn alloy does not transform perceptibly without an applied field, but exhibits isothermal C-curve kinetics in fields above 60 KOe (4.8 x 10^6 ampere/m). The average volume per martensitic plate ad the average plate orientation are found to be insensitive to the strength and direction of the magnetic field, undoubtedly indicating the dominance of autocatalytic nucleation during the course of the isothermal transformation. However, there

is some tendency for the morphology to become less lath-like and more plate-like with increasing field strength at a given transformation temperature, and likewise with increasing temperature at a given driving force. Evidently, the prevailing view that martensite becomes more plate-like with decreasing transformation temperature is a consequence of the attendant increase in driving force rather than a pure thermal effect. Nucleation rate measurements have also been carried out as a function of temperature and magnetic-field strength. In testing nucleation models against these results, it is necessary to take into account the effects of magnetic field, as well as of temperature, on the elastic constants.

51914 Dislocation slip-band mobility in ordered Cu_3Au. Liang, S.; Pope, D.P. (Xerox Corporation, Rochester, New York 14600). *J. Appl. Phys.;* **50**: No. 9, 5726-5730(Sep 1979).

Dislocation slip-band velocities were measured at 77- and 300-K in well-ordered Cu_3Au single crystals. The results of the 77 and 300 K experiments were very similar: No slip-band motion is produced at stresses below a critical stress approximately equal to the macroscopic-yield stress, and bands that were produced during one-load pulse were never observed to move during subsequent load applications. The slip-band velocity increases very rapidly in a small stress range above the critical stress.

51915 Potential energy curves for diatomic zinc and cadmium. Bender, C.F.; Rescigno, T.N.; Schaefer, H.F. III; Orel, A.E. (Theoretical Atomic and Molecular Physics Group, Lawrence Livermore Laboratory, University of California, Livermore, California 94550). *J. Chem. Phys.;* **71**: No. 3, 1122-1127(1 Aug 1979).

Molecular electronic structure theory has been applied to the low-lying electronic states of Zn_2 and Cd_2. Gaussian basis sets of size Zn (13s 9p 5d) and Cd (15s 11p 7d) have been optimized in atomic calculations on the ground ^1S and excited ^3P electronic states. The general contraction scheme of Raffenetti has been used to reduce these primitive Gaussian bases to size Zn (5s 4p 1d) and Cd (6s 4p 2d) without any degradation in the atomic SCF energies. Following X $^1\Sigma^+$/sub g/ ground state SCF calculations, full configuration interaction was performed for the four valence electrons. The resulting potential energy curves for Zn_2 and Cd_2 are, with some notable exceptions, qualitatively similar. In the case of Cd_2, we have obtained potential curves which include spin—orbit coupling and have carried out a detailed analysis of the fluorescence intensity from the first 1/sub u/ ($^3\Sigma^+$/sub u/) excited state.

51916 Computer simulation of the time evolution of a quenched model alloy in the nucleation region. Marro, J.; Lebowitz, J.L.; Kalos, M.H. (Departamento de Fisica Teorica, Universidad de Barcelona, Barcelona 28, Spain). *Phys. Rev. Lett.;* **43**: No. 4, 282-285(23 Jul 1979).

The time evolution of the structure function and of the cluster (or grain) distribution following quenching in a model binary alloy with a small concentration of minority atoms is obtained from computer simulations. The structure function S-bar (k,t) obeys a simple scaling relation, S-bar (k,t) = $K^{-3}F$ (k/K) with K (t) proportional t/sup -a/, a $\simeq$ 0.25, during the latter and larger part of the evolution. During the same period, the mean cluster size grows approximately linearly with time.

51917 Zr—Re phase diagram between 1866 to 1913°K. Garg, S.P. (Bhabha Atomic Research Center, Bombay, India); Ackermann, R.J. *Scr. Metall.;* **13**: No. 7, 611-613(Jul 1979).

The Zr—Re system (1) is characterized with the existence of three peritectic compounds Zr_5Re_{24}, $ZrRe_2$, and Zr_2Re and an eutectic between Zr_2Re and Zr in the high temperature regions. A part of the Zr—Re phase diagram between 1866 to 1913 K was determined employing different methods recently developed. The methods have been used earlier for determination of similar binary phase diagrams such as Zr—Moand Hf—Mo (5), Th—Mo, U—Mo, Th—Re and U—Re (6), Zr—O (7) and Zr—W (8).

51918 Formation of diamond-cubic eta phase in Type 316 stainless steel exposed to thermal aging or irradiation environments. Maziasz, P.J. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Scr. Metall.;* **13**: No. 7, 621-626(Jul 1979).

Precipitation in Type 316 stainless steel in thermal aging, fast reactor or mixed spectrum reactor environments was examined by many workers. Many properties such as strength, corrosion resistance or swelling resistance can be sensitive either to precipitation directly or to changes in the composition of the matrix induced by the precipitation. After irradiation in the Experimental Breeder reactor II (EBR-II) or High Flux Isotope Reactor (HFIR) or after thermal aging, eta phase is found in solution-annealed 316 (1 h at 1050°C) and 20% cold-worked 316. Based upon data reported in the literature, the widespread appearance and dominance of the diamond-cubic eta phase in Type 316 already investigated, whether thermally aged or irradiated, should at least be considered a distinct possibility because the phase has been found in this heat of Type 316 and because it can be difficult to detect. The direct relation between alloy composition, microstructure and properties means that it is important that precipitation behavior be characterized and understood in order to improve elevated-temperature performance and to support predictions of properties.

51919 Grain growth in Ir-0.3 Pct W alloys. Harasyn, D.E.; Schaffhauser, A.C. (Oak Ridge National Lab., TN). *Metall. Trans., A;* **10A**: No. 7, 823-830(Jul 1979).

The fuel cladding material for radioisotope heat sources operating above 1300°C is currently an Ir-0.3 pct W alloy. The ductility of this material under high-temperature impact accident conditions is reduced by large grain sizes. Knowledge of grain size as a function of time and temperature is required to determine the effects of high-temperature exposure during fabrication, assembly, ground testing, and operation of the heat source. The average grain diameter of three different heats of Ir-0.3 pct W is reported as a function of time at 1583 K (1310°C), 1688 K (1415°C), and 1808 K (1535°C) up to 2000 h. Growth rates were measured both perpendicular and parallel to the sheet surface in longitudinal cross sections of sheet samples. In samples with Th, Al, Fe, Ni, and Rh dopant additions, the grain structure was elongated and grain growth was retarded. Grain size was measured by the line intercept method and the data were described by the grain growth equation, $d^2 - d_0^2 = kt$. An activation energy for grain growth was determined for each heat, in both the perpendicular and parallel directions, and was found to be consistent with the expected activation energy for self-diffusion in the alloy. Abnormal grain growth was not observed within the time and temperature ranges of this experiment.

51920 Phase transformations in Ti-3Al-8V-6Cr-4Zr-4Mo. Headley, T.J.; Rack, H.J. (Sandia Labs, Albuquerque, NM). *Metall. Trans., A;* **10A**: No. 7, 909-920(Jul 1979).

The time-temperature-transformation behavior of a metastable β-titanium alloy, Ti-3Al-8V-6Cr-4Zr-4Mo (RMI 38644), has been examined using hardness, X-ray measurements, and optical and transmission electron microscopy. This examination has shown that a variety of metastable and stable phases may form in this alloy system. These include metastable zones, ω, both Burgers (Type 1) α and non-Burgers (Type 2) α, $TiCr_2$, and a Ti-Zr-silicide. A composite TTT diagram is presented which describes the influence of aging time and temperature on the stability of these phases. Finally, the appearance of these transformation products is correlated with the observed hardness changes when RMI 38644 is aged at elevated temperatures.

51921 Crystal structure of zeta-Pu-Zr, ideal formula $Pu_{28}Zr$. Cromer, D.T. (Los Alamos Scientific Lab., NM (USA)). *Acta Crystallogr., Sect. B;* **35**: No. 1, 14-19(15 Jan 1979).

The crystal structure of the zeta phase in the Pu-Zr system, ideal formula $Pu_{28}Zr$, has been deduced and refined from the X-ray powder pattern. Refinement was by the pattern-fitting, structure-refinement technique. The space group is $I4_1/a$; there are four formula units in the unit cell with a = 18.1899 (3) and c = 7.8576 (2) A at 293 K. The structure has a few features in common with β-Pu. There is one very short interatomic distance of 2.50 A. The number of neighbors of Pu varies from 12 to 14 while the presumed Zr site has 16 neighbors. However, no direct evidence of Zr ordering was obtained. The average number of valence electrons per atom is 5.2, the same as in γ-Pu.

51922 Lattice parameters and volume compressibility of ytterbium up to 300 KBAR. Syassen, K.; Holzapfel, W.B. (Max-Planck-Institut fuer Festkoerperforschung, Stuttgart, Germany). pp 223-226 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

The rare earth metal Ytterbium is close to the divalent state under ambient conditions. Pseudopotential calculations have predicted an electronic transition towards the trivalent state under a pressure of about 120 kbar. This transition is related to the promotion of an occupied 4f level near to and above the Fermi level, and it is difficult to predict whether this transition is continuous like the γ—α transition of Ce above its tricritical point or discontinuous like the γ—α transition of Ce below its tricritical point. Information about the electronic transition in Yb can be obtained from the high pressure equation of state (EOS). The isothermal compression of Yb up to 300 kbar using high pressure x-ray diffraction techniques was studied. These data are compared with the equation of states of the other rare earth metals.

51923 Gallium in the alpha and delta plutonium lattice. Fischer, R.B. (Rockwell International, Golden, CO). pp 287-296 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

The stability of delta-phase plutonium—gallium alloys is a subject of great interest to plutonium metallurgists. The present effort introduces some general ideas that are offered in an attempt to further an understanding of the nature of the delta-phase plutonium—gallium alloys and their stability. Special attention is given to a hypothesis relating to the role of gallium atom positions in the plutonium lattice.

MECHANICAL PROPERTIES

REFER ALSO TO CITATION(S) 51011, 51462, 51467, 51468, 51482, 51488, 51523, 51530, 51556, 51566, 51568, 51599, 51600, 51604, 51607, 51609, 51614, 51618, 51626, 51628, 51663, 51696, 51748, 51905, 51912, 51918, 51959, 51977, 51980, 52388, 52389

51924 (AD-A—060741) **Effect of heat treatment on fatigue crack propagation and deformation mode in Alloy 718 at elevated temperatures. Interim report.** Smith, H.H.; Michel, D.J. (Naval Research Lab., Washington, DC (USA)). Jul 1978. 39p. Y A03/MF A01.

Alloy 718 is a commercial, wrought nickel-base alloy widely utilized in moderate temperature structural applications and has been proposed for use in advanced nuclear systems. In such applications, Alloy 718 will experience the combined effects of cyclic and static loading and sustained elevated temperatures. However, when used in structures requiring welds, Alloy 718 exhibits reduced weld ductility and strain age cracking when given conventional post-weld duplex age heat treatments. A modified heat treatment has been previously proposed to obviate these problems and thereby improve structural reliability. The effect of conventional and modified heat treatments and combined cyclic and static loading (hold time) on crack propagation and deformation mode in two heats of Alloy 718 plate material was investigated at 427 and 593 deg C. The fatigue results show that, in general, the resistance of Alloy 718 to crack propagation at these temperatures was not adversely affected by the modified heat treatment and, under most conditions, was found to be improved in comparison with the conventional heat treatment. Scanning electron microscopy (SEM) examination of the fracture surfaces of the fatigue specimens revealed that the failure mode was dependent on test temperature and heat treatment. The material given the conventional heat treatment exhibited transgranular failure modes at both test temperatures. On the other hand, the modified heat treatment produced transgranular fractures at 427 deg C and intergranular or a mixed failure mode at 593 deg C.

51925 (CONF-790736—1) **Elevated temperature exposure has significant effects on the structure of austenitic stainless steel welds.** Edmonds, D.P.; Gray, R.J. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 10p. P 02/MF A01.

From International Metallographic Society conference; Montreal, Canada (16 Jul 1979).

In order to minimize hot-cracking in austenitic stainless steel weld metals, the chemical compositions are generally adjusted to produce small amounts of δ-ferrite in the microstructure. Levels of ferrite in the range of 2 to 15 FN are acceptable for welds in these materials. An investigation of effects of aging and testing at 593°C on the structures of type 308 stainless steel weld metals were investigated. Shielded metal-arc (SMA) welds were made with electrodes formulated by a commercial manufacturer to produce four different concentration levels of δ-ferrite. By varying the chromium-to-nickel concentration ratios (within the type 308 limits) in the deposits, weld metals with nominally 2, 5, 10, and 15 FN were produced. Specimens from these materials were aged and creep tested in air at 593°C for times up to 36 Ms. Aged specimens were Charpy impact tested at room temperature. Both creep and impact-tested specimens were then examined metallographically.

51926 (COO—2733-17) **Elongation upon torsion in a theory for the inelastic behavior of metals.** Van Arsdale, W.E.; Hart, E.W.; Jenkins, J.T. (Cornell Univ., Ithaca, NY (USA). Dept. of Theoretical and Applied Mechanics). Nov 1978. Contract EY-76-S-02-2733. 32p. P 03/MF A01.

The torsion of a thin-walled cylinder is studied using the low temperature or visco-plastic limit of Hart's state variable theory for the inelastic behavior of metals. For values of the shear stress lower than the hardness of the material, reversible elongation is found to accompany the recoverable twist. For shear stress exceeding the hardness, there are, in addition, a permanent twist and elongation. These predictions agree qualitatively with existing experiments. Detailed quantitative results, for several loading histories, are obtained for Nickel.

51927 (COO—2733-19) **Thermoviscoplastic response of cylindrical structures using a state variable model.** Mukherjee, S. (Cornell Univ., Ithaca, NY (USA). Dept. of Theoretical and Applied Mechanics). Feb 1979. Contract EY-76-S-02-2733. 27p. P 03/MF A01.

A number of combined creep-plasticity constitutive models with state variables have been recently proposed to describe time-dependent inelastic deformation of metals at elevated temperatures. Some of these models seem capable of more faithfully predicting material behavior under complex mechanical and thermal loading histories than is currently possible with traditional models which use separation of time-independent plasticity and time-dependent creep. For some time interest in the efficient numerical solution of boundary value problems using constitutive models was shown. A particularly promising model was used in the calculations. This model has been used to predict the uniaxial responses of several metals and alloys to various types of loading histories. The correlation between model predictions and experiments was found to be very good. Stresses and deformation in cylindrical structures subjected to time-dependent axisymmetric mechanical and thermal loads was studied. Several physically observed phenomena that cannot be simulated by traditional models are discussed. The computational scheme used is very efficient.

51928 (COO—2733-20) **Improved boundary-integral equation method for time-dependent inelastic deformation in metals.** Morjaria, M.; Mukherjee, S. (Cornell Univ., Ithaca, NY (USA). Dept. of Theoretical and Applied Mechanics). Feb 1979. Contract EY-76-S-02-2733. 31p. P 03/MF A01.

Efficient solution of boundary-value problems for time-dependent inelastic deformation in metallic structures are generally solved by finite element methods and separate descriptions for time-independent plasticity and time-dependent creep are normally used. The boundary-integral equation method was recently applied for the first time to such problems. A very efficient numerical implementation of the method with a linear description of the relevant variables over each boundary element and a newly developed Euler type time-integration scheme with automatic time-step control for time integration is presented. Numerical results for plates in plane stress with and without cutouts, under different loading histories, are presented. A combined creep-plasticity constitutive theory with state variables is used to model material behavior. The results are more accurate and are obtained with much less computational effort compared to a previous attempt with an uniform description of variables over each boundary element and a predictor—corrector scheme for time-integration. The computer program developed is quite general and can handle plane stress problems for plates of arbitrary shapes subjected to arbitrary time-histories of loadings. The numerical results presented in the paper are for certain illustrative problems.

51929 (COO—3084-65) **Elastic plastic analysis of growing cracks.** Rice, J.R.; Drugan, W.J.; Sham, T.L. (Brown Univ., Providence, RI (USA). Div. of Engineering). May 1979. Contract EY-76-S-02-3084. 55p. (CONF-7905104—1). P 04/MF A01.

From 12. annual symposium on fracture mechanics; St Louis, MO, USA (21 May 1979).

The elastic—plastic stress and deformation fields at the tip of a crack which grows in an ideally plastic solid under plane strain, shows small scale yielding conditions. Results of an asymptotic analysis suggests the existence of a crack tip stress state similar to that of the classical Prandtl field, but containing a zone of elastic unloading between the centered fan region and the trailing constant stress plastic region. The near tip expression for the rate of opening displacement δ at distance r from the growing tip is found to have the form δ-. = α J-./σ/sub o/ + β(σ/sub o//E) a-. ln(R/r) but the presence of the elastic wedge causes β to have the revised value of 5.08 (for Poisson ratio ν = 0.3); also, (a = crack length, σ/sub o/ = yield strength, E = elastic modulus, and J denotes the far-field value), and $(1-\nu^2)K^2/E$ for the small scale yielding conditions considered. The parameters α and R cannot be determined from the asymptotic analysis, but comparisons with finite element solutions suggest that, for small amounts of growth, α is approximately the same for stationary and growing cracks, and R scales approximately with the size of the plastic zone, being about 15% to 30% larger. For large scale yielding, a similar form applies with possible variations in α and β, in cases which maintain triaxial constraint at the crack tip. In the fully yielded case R is expected to be proportional to the dimension of the uncracked ligament. Model crack growth criterion requiring a critical δ at some fixed r from the tip, is re-examined in light of the more accurate solution. Results suggest that the J versus Δa relation describing growth is dependent on the extent of yielding. It is suggested that this dependency might be small for highly ductile materials, provided that a similar triaxial constraint is maintained in all cases.

51930 (COO—3084-69) **Combined macroscopic and microscopic approach to the fracture of metals. Technical progress report.** Asaro, R.J.; Gurland, J.; Needleman, A.; Rice, R.J. (Brown Univ., Providence, RI (USA). Div. of Engineering). Jun 1979. Contract EY-76-S-02-3084. 58p. P 04/MF A01.

Progress is reported on microscopic fracture mechanisms, including studies of void and crack initiation in steels in the absence and presence of hydrogen, the effects of hydrogen on ductile fracture in medium and high carbon steels; elastic—plastic crack growth including the quasi-stable growth of cracks in ductile solids under increasing load and conditions of instability; and elevated tempera-

ture rupture including analysis of the stress field near a crack tip in an elastic-nonlinear viscous material under tensile load as well as the processes of diffusion, and cavitation of grain boundaries in plastically creeping materials. (FS)

51931 (COO—3459-14) **Fatigue and delayed failure of refractory metals. Annual report.** Stoloff, N.S. (Rensselaer Polytechnic Inst., Troy, NY (USA)). 15 Jan 1979. Contract EY-76-S-02-3459. 22p. P 02/MF A01.

Research is reported concerning delayed failure and fatigue behavior of polycrystalline vanadium and niobium and their alloys with hydrogen including delayed failure of Nb—H alloys, effect of temperature on fatigue life in vacuum, and crack propagation vs stress intensity. Previously reported results on delayed failure of hydrided vanadium are reviewed with attention to details of the fracture process. A review is presented concerning mechanical properties of candidate first wall materials indicating the importance of fatigue and creep. (FS)

51932 (COO—4072-2) **Strain hardening and ductility of iron: axisymmetric vs. plane strain elongation. Technical progress report.** Langford, G. (Drexel Univ., Philadelphia, PA (USA). Dept. of Materials Engineering). May 1979. Contract EY-76-S-02-4072. 37p. P 03/MF A01.

The strain hardening of iron at high strains in plane strain elongation (strip drawing) is shown to fall increasngly below that of drawn iron wires at true strains above 2. This makes it unnecessary to invoke shear band formation simultaneously as a strengthening mechanism and as a ductility reducing mechanism in the drawn strip. Rather, shear bands may be a weakening mechanism in all contexts. A set of specimens of interstitial-free iron deformed in three of the four main classifications of deformation symmetry (wire, strip, and chips, representing axisymmetric elongation, plane strain elongation, and pure shear) has been prepared in the form of mechanical test specimens and thin foils for high resolution selected area diffraction. A simple technique for rapid discovery of the <110> axis of foils of strongly textured bcc wire has been worked out.

51933 (DOE/ET—0058/5, pp 64-69) **Fracture mode of nomonic PE-16 following irradiation in HFIR.** Wiffen, F.W. (Oak Ridge National Lab., TN). 1979.

In Alloy development for irradiation performance. Quarterly progress report for period ending March 31, 1979.

Examination of a series of irradiation and tensile tested PE-16 specimens showed that grain boundary separation was the predominant facture mode over a wide range of conditions. For irradiation and test at 300°C the transition from a ductile shear fracture to mainly grain boundary separation occrred at a fluence producing approximately 1000 at. ppM He. At 600 and 700°C all observed fractures were intergranular, even at as low as 350 at. ppM He. Although most failures were by grain separation, total elongations up to 10% were observed, usually accompanied by slip steps on the boundaries or limited areas of dimples characteristic of ductile tearing. Exposed boundaries showed evidence of the underlying precipitate structure, with boundaries at 300°C relatively clean, and the coarseness of the precipitate increasing with increasing irradiation temperature.

51934 (HEDL-SA—1750) **Fatigue-crack propagation response of two nickel-base alloys in a liquid sodium environment.** Mills, W.J.; James, L.A. (Hanford Engineering Development Lab., Richland, WA (USA)). 23 Jan 1979. Contract EY-76-C-14-2170. 31p. (CONF-790615—20). P 03/MF A01.

From 3. US national congress on pressure vessels and piping; San Francisco, CA, USA (25 Jun 1979).

The elevated temperature fatigue-crack propagation response of Inconel 600 and Inconel 718 was characterized within a linear-elastic fracture mechanics framework in air and low-oxygen liquid sodium environments. The crack growth rates of both nickel-base alloys tested in liquid sodium were found to be considerably lower than those obtained in air. This enhanced fatigue resistance in sodium was attributed to the very low oxygen content in the inert sodium environment. Electron fractographic examination of the Inconel 600 and Inconel 718 fatigue fracture surfaces revealed that operative crack growth mechanisms were dependent on the prevailing stress intensity level. Under low growth rate conditions, Inconel 600 and Inconel 718 fracture surfaces exhibited a faceted, crystallographic morphology in both air and sodium environments. In the higher growth rate regime, fatigue striations were observed; however, striations formed in sodium were rather ill-defined. These indistinct striations were attributed to the absence of oxygen in the liquid sodium environment. Striation spacing measurements were found to be in excellent agreement with macroscopic growth rates in both environments.

51935 (LBL—9260) **Alloying and heat treatment optimization of Fe/Cr/C steels for improved mechanical properties.** Sarikaya, M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1979. Contract W-7405-ENG-48. 89p. P 05/MF A01.

Thesis.

The effects of alloying elements and heat treatments on the microstructural changes and strength-toughness properties were investigated in optimization of vacuum melted Fe/Cr/C base steels. The structure of the steels in the as-quenched conditions consisted of highly dislocated autotempered lath martensite (strong phase) and thin continuous interlath films of retained austenite (tough phase). It has been emphasized again that the mechanical properties of the steels are sensitive to the amount and the stability of retained austenite. To increase the stability of retained austenite in the as-quenched condition 2 w/o Mn or 2 w/o Ni was added to the base steel, viz., Fe/3Cr/0.3C. Partial replacement of Cr by about 0.5 w/o Mo did not alter the beneficial microstructure.

51936 **Intergranular embrittlement of Pt—30% Rh—8% W by Se VAPOR.** White, C.L.; Keiser, J.R.; Heatherly, L.; Newsome, J.F. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Scr. Metall.;* **13**: No. 7, 543-547(Jul 1979).

The alloy Pt—30 wt % RH—8 wt % W (Pt-3008) which was developed at ORNL is a candidate structural material for use in a new generation of radioisotopic thermoelectric generators (RTGs). These RTGs will employ thermoelectric elements based on Gd_2Se_3 and Cu_2Se, operating at temperatures as high as 900°C. Compatability studies have shown that grain boundaries in Pt-3008 are embrittled upon exposure to Se vapor. Initial findings concerning the embrittlement phenomenon are reported.

51937 **Role of prior austenite grain size on the tensile ductility and fracture toughness of 18Ni maraging steels.** Rack, H.J. (Sandia Labs., Albuquerque, NM). Contract DE-AC04-76-DP00789. *Scr. Metall.;* **13**: No. 7, 577-582(Jul 1979).

This communication describes the results of an investigation which was undertaken to clarify the contradictory effects of grain size variation on the tensile ductility and fracture toughness of aged 18Ni maraging steel and the possible underlying causes for the fracture mode transitions observed. Varying prior austenite grain size does not effect tensile ductility or fracture toughness. Increasing grain size does result in a decrease in tensile ductility. Fracture mode changes in the aged condition.

51938 **Acoustic emission from hydrogen saturated Type 304L stainless steel.** Caskey, G.R. Jr. (E.I. du Pont de Nemours and Co., Aiken, SC). Contract AT(07-2)-1. *Scr. Metall.;* **13**: No. 7, 583-587(Jul 1979).

Effects of hydrogen on tensile deformation and fracture of austenitic stainless steels vary widely, depending upon the steel composition and treatment, hydrogen exposure, and loading conditions. In alloys such as Type 310 and Type 316 stainless steel, the ductility loss is small; and the fracture mode is unchanged. In contrast, Type 304L, 21-6-9, and Tenelon display large ductility losses with a change from ductile rupture to transgranular cleavage at 200 to 270 K. Intergranular fractures are observed in notched tensile tests of sensitized stainless steel at room temperature. Transgranular cleavage is observed after hydrogen exposure. The cleavage varies with test temperature, hydrogen concentration, and grain size. Microcracks form preferentially aong coherent twin boundaries throughout the deformed metal but are observable only after a 12 to 14% plastic strain. Microcracks along grain boundaries occur less frequently. The microcracks and consequent cleavage failure appear closely related to the stability of the austenite with respect to the ϵ-phase as measured by stacking-fault energy and may also be related to the strain induced martensite. The mechanism of microcrack nucleation and growth is not certain.

51939 **High-pressure science and technology. Volume 2. Applications and mechanical properties.** Timmerhaus, K.D.; Barber, M.S. (eds.). Contract ER-78-C-02-4618. New York, NY; Plenum Press (1979). 1070p. (COO—4618-1(Vol.2); CONF-770706—P2). Plenum Press, New York, NY.

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Separate abstracts have been prepared for items within the scope of the energy data base. (FS)

51940 **Dynamic fracture toughness. Volume 2. Discussion.** Abington, England; Welding Institute (1979). 61p. (CONF-760705—P2).

From Conference on dynamic fracture toughness; London, UK (5 Jul 1976).

Discussions are presented concerning elastic fracture initiation and propagation, and elastic—plastic fracture initiation and propagation. (FS)

PHYSICAL PROPERTIES

REFER ALSO TO CITATION(S) 51653, 51905, 51922, 51923, 51933, 52000, 52329, 52330

51941 (AD-A—060713) **High transition temperature superconductors - V_3Ga wire development. Annual report.** Hein, R.A.; Francavilla, T.L.; Gubser, D.U.; Howe, D.G.; Meussner, R.A. (Naval Research Lab., Washington, DC (USA)). May 1978. 38p. Y A03/MF A01.

Increased V_3Ga growth rates resulting from the use of high gallium content V-Ga filaments and Cu-Ga matrix alloys are utilized to improve the critical current density in the superconductor, J sub c, by forming thin layers of V_3Ga at rather low reaction temperatures. Studies of J sub c as functions of magnetic field strength and temperature are reported and compared with similar data for experimental Nb_3Sn wires, commercial V_3Ga tapes, and Nb-Ti wire. These data document the superiority of V_3Ga over a broad range of magnetic fields and temperatures. Based on results of these investigations of processing variables, specifications for high-current (I sub c) multifilament V_3Ga wires were defined and an industrial contract for their production was awarded (pertinent specifications appended). Studies of stress effects on I sub c have shown these developmental wires resistant to degradation at acceptable stress levels. Further work in this area is recommended for future superconducting applications.

51942 (BNL—26391) **Superconducting properties of $(Nb,Ta)_3Sn$ wires fabricated by the bronze process.** Suenaga, M.; Aihara, K.; Kaiho, K.; Luhman, T.S. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 19p. (CONF-790815—9). P 02/MF A01.

From Cryogenic engineering conference; Madison, WI, USA (21 Aug 1979).

Measurements of the superconducting critical temperature T/sub c/, critical current density, J/sub c/ (8<H<22.5 T), and the critical magnetic field H/sub c2/ were made on bronze processed $(Nb,Ta)_3Sn$ monofilamentary wires. Ta content in the Nb_3Sn compound was varied by alloying the Nb core prior to a reaction heat treatment. Core compositions were 0, 3, 7, 10, and 20 wt% Ta and heat treatments for the reaction were 16, 64, and 120 h at 725°C. For the 120 h heat treatment T/sub c/ decreased monotonically with Ta content from 17.5 to 15.7K while H/sub c2/ increased from 19.8 to 24.6 T. With increasing Ta content J/sub c/ (16 T) increased from 0.7×10^5 A/cm² to a maximum value of 1.3×10^5 at 7 wt% Ta. Further increases in the Ta content produced a decrease in J/sub c/ (16 T). At 10 T J/sub c/ decreased with increasing Ta content. An important aspect of this work is the observation that alloying with Ta did not hinder wire ductility during drawing. It appears therefore that the improvements in J/sub c/(16 T) can be incorporated into commercially manufactured conductors.

51943 (COO—4381-6) **Measurement of roughness-induced wavelength corrections to the surface plasmon resonance in silver.** Bush, J.A.; Cohen, D.K.; Scherkoske, K.D.; Sari, S.O. (Arizona Univ., Tucson (USA). Optical Sciences Center). 1979. Contract EG-77-S-02-4381. 12p. P 02/MF A01.

A systematic study was made of the wavelength position of the surface plasma resonance in roughened silver foils. Frequency shifts in the resonance peak, produced by varying surface roughness parameters, were interpreted using a model calculation. A self-consistent comparison was made to angular scattered-light distributions from the same foils. Remarks are given concerning changes in silver reflectivity due to annealing.

51944 (DOE/ET—0058/5, pp 36-62) **Microstructural characterization of as-received prime candidate alloy and examination of microstructural sensitivity to fabrication and processing varialbles.** Maziasz, P.J.; Roche, T.K. (Oak Ridge National Lab., TN). 1979.

In Alloy development for irradiation performance. Quarterly progress report for period ending March 31, 1979.

Several finished product forms of the Path A Prime Candidate Alloy have been received from Teledyne Allvac and examined to characterize its homogeneity with respect to dissolved titanium and TiC. Inhomogeneities were found in material removed at an intermediate material, both as received and after homogenization at 1200°C for 24 h. Some sensitivity to cooling rate after homogenization was found in the TiC distribution and the resulting amount of recrystallization, but the greatest microstructural sensitivity was found when unhomogenized and homogenized material were compared.

51945 (DOE/ET—0058/5, pp 132-140) **Hydrogen dissolution and permeation characteristics of titanium-base alloys.** Van Deventer, E.H.; Veleckis, E.; Maroni, V.A. (Argonne National Lab., IL). 1979.

In Alloy development for irradiaton performance. Quarterly progress report for period ending March 31, 1979.

Hydrogen dissolution in pure Ti—6Al—4V and the hydrogen permeation characteristics of an ion-nitride coated sample of Ti—6Al—4V have been evaluated. The permeability of the coated sample was at most ten times lower than had been observed for uncoated Ti—6Al—4V in the temperature range from 350 to 550°C. The solubility parameter for pure Ti—6Al—4V (Sieverts' constant) ranged from 360 wppM H/torr/sup 1/2/ at 500°C to 1600 wppM H/torr/sup 1/2/ at 700°C. The pressure exponent observed for the permeability relationship, ~ 0.8, indicated that surface interactions were affecting the hydrogen migration mechanism. The generally high hydrogen solubility and permeability exhibited by titanium-alloys must be considered as an important area of concern in any assessments of the reactor first-wall/blanket systems.

51946 (LA-UR—79-2094) **Magnetic behavior at the iron sites in Pd Fe Mn alloys.** Taylor, R.D.; Willis, J.O. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 8p. (CONF-790909—2). P 02/MF A01.

From International conference on magnetism; Munich, F.R. Germany (Sep 1979).

Moessbauer Effect hyperfine measurements of $(Pd_{0.9965}Fe_{0.0035})$/sub 1-x/Mn/sub x/ have been obtained for $1.1 < T < 30$ K and $0 < H < 6T$ for $x = 0.01$, 0.05, 0.06, and 0.065. Ferromagnetic ordering is clear for $x = 0.01$ and is suggested for $x = 0.05$ at 4 K. At 1.1 K ordering at the iron sites in all samples, except $x = 0.01$, is consistent with a spin-glass or antiferromagnetic phase.

51947 (SAND—79-0791C) **Electron spectroscopic investigations of the oxidation of beryllium.** Madden, H.H.; Zehner, D.M. (Sandia Labs., Albuquerque, NM (USA); Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26;EY-76-C-04-0789. 7p. (CONF-7906113—1; CONF-7906114—1). P 02/MF A01.

From 9. conference on surface studies; Golden, CO, USA (26 Jun 1979).

Measurements were made on clean and oxidized Be surfaces to investigate the changes in electronic structure of the Be surface upon exidation. (FS)

51948 **Effect of H_2O on the ionic conductivity of sodium beta-alumina.** Kaneda, T.; Bates, J.B.; Wang, J.C.; Engstrom, H. (Oak Ridge National Lab., TN). *Mater. Res. Bull.;* **14**: No. 8, 1053-1056(Aug 1979).

The effect of water molecules on the ionic conductivity of sodium beta-alumina single crystals was investigated. Water molecules intercalated in the conducting plane lower than the conductivity by as much as a factor of two.

51949 **Nuclear magnetic ordering in $PrCu_6$.** Babcock, J.; Kiely, J.; Manley, T.; Weyhmann, W. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455). *Phys. Rev. Lett.;* **43**: No. 5, 380-383(30 Jul 1979).

We have observed in $PrCu_6$ a sharp peak in the heat capacity and rapid change in the magnetization at 2.5 mK consistent with the occurrence of nuclear magnetic ordering below that temperature. Applying magnetic fields greater than 100 G rounds the transition. The behavior observed is similar to ferromagnetism in electronic systems, but other structures showing weak "ferromagnetism" are not ruled out.

51950 **Observation of surface traps and vacancy trapping with slow positrons.** Lynn, K.G. (Brookhaven National Laboratory, Upton, New York 11973). *Phys. Rev. Lett.;* **43**: No. 5, 391-394(30 Jul 1979).

A beam of monoenergetic positrons incident on clean metallic surfaces has been employed to measure positronium yield as a function of sample temperature and positron energy. These results show an increase in the positronium fraction as a function of temperature which is identified as thermally activated detrapping of positrons from a surface trap. Estimates are made of the depths of these traps. Positrons are observed to trap at vacancies and a monovacancy formation enthalpy is extracted from the data utilizing a simple model.

51951 **Enhancement of hydrogen uptake rates for Nb and Ta by thin surface overlayers.** Pick, M.A.; Davenport, J.W.; Strongin, M.; Dienes, G.J. (Brookhaven National Laboratory, Upton, New York 11973). *Phys. Rev. Lett.;* **43**: No. 4, 286-289(23 Jul 1979).

It is shown that thin layers of Pd or Pt enhance the uptake rate of hydrogen into bulk Nb withn almost every hydrogen atom that hits the surface passing into the bulk. A model for the kinetics is formulated showing that in a composite-system large uptake rates are achieved by combining the surface properties of Pd with the bulk properties of Nb, thereby resulting in a smaller barrier for migration into the bulk.

51952 **Spin-flip scattering and the dynamics of the superconducting order parameter.** Aspen, F.; Goldman, A.M. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455). *Phys. Rev. Lett.;* **43**: No. 4, 307-310(23 Jul 1979).

Pair-field susceptibilities of Al films doped with the magnetic impurity Er have been measured. The spin-flip scattering time determined from studies above T/sub c/ is consistent with the results of electron spin resonance measurements. Below T/sub c/ the transverse mode of the order parameter propagates only when there is a gap in the excitation spectrum.

51953 Dilute solution of hydrogen and deuterium in β-titanium. Lynch, J.F.; Tanaka, J. (Brookhaven National Lab., Upton, NY). Contract EY-76-C-02-0016. *Scr. Metall.;* **13**: No. 7, 599-604(Jul 1979).

Recent work in this Laboratory concerning the solution of hydrogen and deuterium in β-stabilized binary titanium alloys (1) has led to our interest in the properties of hydrogen in pure β-Ti (T > 1155 K). Examination of the literature reveals that data regarding the dilute solution of hydrogen in β-Ti are scarce. The reported results are somewhat scattered, as is evident in the available thermodynamic data which we have collected in Table 1. An independent examination of the solution of H in β-Ti was made and the results are presented.

51954 Status of equation of state of solids. Ruoff, A.L. (Cornell Univ., Ithaca, NY); Chhabildas, L.C. pp 19-32 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Equation of state measurements, namely pressure—volume—temperature measurements enables one not only to evaluate thermodynamic parameters but also to get some insight into the nature of atomic and macroscopic theories. The measurement of volume as a function of pressure can be accomplished as follows: Length change measurement techniques; piston volume displacement techniques; ultrasonic techniques; combined length change and ultrasonic transit time measurement; Brillouin scattering techniques; and shock wave techniques. Each technique has its advantages and serious limitations. The precision and errors associated with these techniques are given. Results for the rare gas solids, alkali metals and alkali halides are discussed. Various equations of state which are normally used to represent data are also discussed.

51955 Isothermal compression of V, Nb, and Ta to 100 KBAR: correlation with ultrasonic, shock wave, and other static data. Ming, L.C.; Manghnani, M.H. (Univ. of Hawaii, Honolulu). pp 54-67 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

The transition metals (V, Nb, and Ta) have bcc structure and easily form bcc alloys with hcp metals, and with bcc metals. The bcc structure of the metals is stable to melting temperatures and is considered to be stable under pressures of the order of several megabars, as no phase transformation has been found at these pressures. Their pressure—volume (P—V) relationships have been investigated by three different means: direct static, isothermal compression measurements up to 30 kbar and up to 45 kbar; use of an equation of state utilizing the ultrasonically measured values of bulk modulus (K_o) and its pressure derivative (K'_o); and reduction of the shock wave Hugoniot data to isothermal P—V relationships based on certain thermodynamic considerations.

51956 New allotropic phase of cerium above 122 KBAR. Endo, S.; Fujioka, N. (Osaka Univ., Toyonaka, Japan); Sasaki, H. pp 217-222 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Cerium metal appears in many different allotropic phases. The existence of two fcc phases, γ and α, has been the subject of extensive study particularly relative to the behavior of the 4f electrons in this transition. At pressures higher than 50 kbar, α-Ce transforms to a superconducting α′ phase. Conflicting results have been reported on the crystal structure of α′-Ce. During the course of an x-ray diffraction study to clarify this situation, another allotropic phase was found around 120 kbar pressure. The crystal structure of the new phase and the resistance change associated with the transition from the α′ phase to the new phase are described.

51957 Anomalous pressure dependence of the superconducting transition temperature of dilute alloys of $LaSn_3$ containing light rare earth inpurities. DeLong, L.E.; Maple, M.B. (Univ. of California, San Diego, La Jolla). pp 320-328 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Earlier measurements of the initial depressions of the transition temperature (T/sub c/) of $LaSn_3$ with RE impurity concentration revealed an unexpected and dramatic deviation from the behavior of other more extensively studied alloy systems. In an effort to further understand the anomalous behavior of these alloys, the effect of hydrostatic pressure P on the T/sub c/ of dilute (LaRE)Sn_3 samples were measured (RE = Y, Ce, Pr, Nd, Sm, Eu, Gd, and Lu). Measurements of the pressure dependence of T/sub c//sub o/ of several pure host samples of $LaSn_3$ yielded results in contradiction with previous measurements.

51958 Thermodynamics of melting for alkali metals. Makarenko, I.N.; Nikolaenko, A.M.; Stishov, S.M. (Inst. of Crystallography of Academy of Sciences, Moscow, USSR). pp 347-356 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

The experimental study of the melting of alkali metals at high pressure is discussed after clarifying the problems. The form of the total energy of alkali metals is considered. (FS)

51959 System of pressure calibration for the range 0.05—1.0 mbar based on shock wave equations of state for Cu, Mo, Pd, and Ag. Mao, H.K.; Bell, P.M. (Carnegie Inst. of Washington, DC); Shaner, J.; Steinberg, D. pp 739-747 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

A review is supplied of the problems involving various calibration methods that have been used in high-pressure research. There are obvious advantages to interpolating a pressure scale between known experimental points compared with extrapolating to a range in which the uncertainties are unknown. A particular function, whether theoretical or empirical, may apply well for a given material but not for others. There is great danger in extrapolating the pressure—volume relations from low-pressure values, but interpolation is always superior. The four metals Cu, Mo, Pd, and Ag were selected as primary calibrants because reliable shock-wave data were available and their physical properties are representative of many materials. These metals undergo no known phase changes in the experimental range, and they are cubic, thereby reducing problems of orientation and anisotropy in shock-wave experiments. These metals have a broad range of compressibility and strength, but their bulk moduli are all greater than 1 Mbar.

CORROSION AND EROSION

REFER ALSO TO CITATION(S) 50988, 50996, 51426, 51837, 51947

51960 (COO—4381-7) **Metal silver-liquid interface: oxide properties from reflectance and scattered light spectroscopy.** Cohen, D.K.; Sari, S.O.; Scherkoske, K.D. (Arizona Univ., Tucson (USA). Optical Sciences Center). 1979. Contract EG-77-S-02-4381. 8p. (CONF-790538—14). P 02/MF A01.

From Fast ion transport in solids-electrode and electrolytes conference; Lake Geneva, WI, USA (21 May 1979).

Electrochemically oxidized silver foils have been examined using a reflectance and scattered light spectroscopy. The effect of unintentional inhomogeneous oxide formation on rough silver metal reflecitivty is given. In contrast, the reflectance contribution of an intentionally formed oxide overlayer may be separated from that of the metal substrate. If the scattering contribution of the oxide-covered silver is small, the differential reflectance between oxidized and clean metal foils may be used to determine the approximate overlayer optical constants. The distribution of oxide module sizes at the metal boundary may be estimated from contributions due to inhomogeneous oxide residues. These results are compared to electron microscopy of the same surfaces.

51961 (DOE/ET—0058/5, pp 141-147) **Corrosion of Ni—Fe—Cr and Co—V—Fe (LRO) alloys in static lithium.** Tortorelli, P.F.; DeVan, J.H. (Oak Ridge National Lab., TN). 1979.

In Alloy development for irradiaton performance. Quarterly progress report for period ending March 31, 1979.

The compatibility of alloy 600 and a 60% Co-25% V-15% Fe ordered alloy with static lithium was investigated. Alloy 600 corroded significantly in pure lithium between 500 and 700°C. However, it lost no weight when exposed to Li-5 wt % Al under otherwise similar conditions. Alloy 600 welds were not significantly attacked by the lithium. A long-range-ordered (LRO) alloy was exposed to lithium at 600 and 850°C for 2000 h and then tensile tested. The samples exposed at 850°C showed no loss of ductility at room temperature and just a small amount of intergranular cracking; however, specimens exposed at 600°C exhibited loss of ductility and an extensive number of grain boundary cracks.

51962 (DOE/ET—0058/5, pp 148-155) **Corrosion in lithium-type 316 stainless steel thermal-convection systems.** Tortorelli, P.F.; DeVan, J.H. (Oak Ridge National Lab., TN). 1979.

In Alloy development for irradiation performance. Quarterly progress report for period ending March 31, 1979.

X-ray fluorescence of the coupons from a type 316 stainless steel thermal-convection loop that circulated lithium with 500 wt ppM N indicated that the addition of nitrogen to the lithium affected the distribution of nickel around the circuit. Metallographic examination revealed that the added nitrogen did not change the basic dissolution mechanism and did not promote intergranular attack. Two type 316 stainless steel loops that had circulated as-purified lithium for long periods of time developed plugs. One of these plugs was examined and appeared to be composed of a tangle of small chromium crystals.

51963 (NTIS/PS—78/1338) **Stress corrosion of stainless steels. Volume 1. 1964—1976 (citations from the NTIS data base). Report for 1964—1976.** Smith, M.F. (National Technical Information Service, Springfield, VA (USA)). Dec 1978. 245p. Y N01/MF N01.

This compilation covers research on deformation, cracking, electrochemistry, additives, kinetics, test methods, and solutions in relation to stress corrosion. A majority of the research concerns nuclear reactor materials and spacecraft components. Citations of mechanical property and compatibility data in relation to stress corrosion are included. Design criteria and corrosion resistance are also discussed. (This updated bibliography contains 239 abstracts, none of which are new entries to the previous edition.)

51964 (NTIS/PS—78/1339) **Stress corrosion of stainless steels. Volume 2. 1977—1978 (citations from the NTIS data base). Report for 1977—1978.** Smith, M.F. (National Technical Information Service, Springfield, VA (USA)). Dec 1978. 82p. Y N01/MF N01.

This compilation covers research on deformation, cracking, electrochemistry, additives, kinetics, test methods and solutions in relation to stress corrosion. A majority of the research concerns nuclear reactor materials, spacecraft components and coal gasification plants. Design criteria and corrosion resistance is also discussed. (This updated bibliography contains 75 abstracts, 28 of which are new entries to the previous edition.)

51965 (SAND—79-1493C) **Formation, adhesion and mechanical/chemical properties of protective coatings.** Mattox, D.M. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 5p. (CONF-790749—1). P 02/MF A01.

From Conference on advanced materials for alternate fuel capable directly fired heat engines; Castine, ME, USA (30 Jul 1979).

Some general considerations for protective coatings are discussed. It is suggested that ceramic coatings may provide a class of coatings applicable to high temperature turbine blades for use in a corrosive/erosive environment. In particular, the ceraming glass materials would seem to hold promise, but little or nothing has been done on depositing these materials by vacuum processes.

51966 Corrosion behavior of selected structural materials in a simulated steam-cycle high-temperature gas-cooled reactor helium environment. Mazandarany, F.N.; Lai, G.Y. (General Atomic Co., San Diego, CA). *Nucl. Technol.;* **43**: No. 3, 349-365(May 1979).

Corrosion of carbon steel, 2 1/4 Cr—1 Mo, Types 422, 304, and 316 stainless steel, Alloy 800 (Grade 2), Alloy 800 H, Inconel 617, and Hastelloy X by gaseous impurities in a simulated steam-cycle high-temperature gas-cooled reactor helium environment was investigated. The corrosion tests were conducted at various temperatures for up to 5000 h. Oxidation was observed in all the alloys investigated except carbon steel as predicted by thermodynamic calculations. Other gas-metal reactions observed included carbon deposition on carbon steel and 2 1/4 Cr—1 Mo, and carburization in Type 316 stainless steel with the as-received surface condition (i.e., annealed and pickled). Thermodynamic considerations were given to rationalize the chemical reaction(s) that dominates the carbon potential in the test environment and to provide a basis for making thermodynamic predictions as to the occurrence of carbon deposition, carburization, and/or decarburization.

51967 In situ measurements of changes of ferromagnetism caused by high pressure gaseous hydrogen. Bauer, H.J. (Univ. of Munich, Germany); Baranowski, B. pp 248-252 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

A pull-out magnetic device was developed to detect formation of hydride phase in Ni and NiFe foils under varying hydrogen pressures. 3 figures. (DLC)

51968 Corrosion characteristics of materials in hypersaline geothermal brine. Harrar, J.E.; McCright, R.D.; Goldberg, A. (Univ. of California, Livermore). *SAMPE Q.;* **10**: No. 1, 1-15(Oct 1978).

A flow cell (with appropriate accessories) was developed for use in short-term testing of the corrosion behavior of materials in ~ 100°C, hypersaline geothermal brine. An apparatus was designed to accommodate commercial (Petrolite) corrosion measurement equipment and to conduct experiments on-line at the Lawrence Livermore Laboratory Test Station in the Salton Sea Geothermal Field. The apparatus also permitted direct readings of corrosion potentials, solution redox potential (E/sub h/), brine flow rate, pH, and temperature. Estimates of general corrosion rates were obtained by the linear polarization resistance technique and from measurements of complete potentiodynamic polarization curves. Twenty-two alloys (with various heat treatments) were tested and readily grouped according to general corrosion resistances in acidified hypersaline (~ 4 M chloride) brine.

RADIATION EFFECTS

REFER ALSO TO CITATION(S) 51556, 51628, 51647, 52304, 52386, 52387

51969 (AD-A—060748) **Cooperative Radiation Effects Simulation Program. Semiannual progress report, 1 March—31 August 1977.** Steele, L.E.; Beach, L.A. (Naval Research Lab., Washington, DC (USA)). Jul 1978. 59p. Y A04/MF A01.

The Cooperation Radiation Effects Simulation Program (CORES) is a collaborative effort of the Engineering Materials and Radiation Technology Divisions of NRL Materials and General Sciences Area. The goal of the research is to provide the theoretical and experimental bases for understanding the mechanisms of nuclear radiation damage of metals, as well as a theoretical insight into energy deposition processes. In this the Van de Graaff and Cyclotron are used to simulate rapidly the radiation damage produced over long periods in reactor neutron environments. Progress for the period 1 March 1977 - 31 August 1977, includes: (1) the completion of a semiautomatic system for the analysis of transmission electron micrographs, (2) profiling hydrogen and helium in parts per million concentration by elastic scattering techniques, and (3) the microstructural characterization of stress and ion-induced transient creep in cold-worked nickel and its comparisons with predictions of creep models. (Author)

51970 (COO—1198-1250) **Ultrasonic studies of radiation damage in an aluminum—manganese alloy.** Johnson, D.L. (Illinois Univ., Urbana (USA). Dept. of Physics). 1978. Contract EY-76-C-02-1198. 92p. P 05/MF A01.

Thesis.

The MHz internal friction technique has been shown to provide accurate measurements of the properties of defects produced by a low dose of electron radiation. In spite of the optimum conditions for avoiding complications due to multiple interstitial and multiple solute atom complexes, the multile peak structure of the data indicated that more than one defect configuration was present. This is in direct contrast with channeling measurements and the interpretation of Moessbauer effect measurements which indicated the defect trapping configuration was the <100> mixed dumbbell. Neither of the two existing models used in the interpretation of other experiments was capable of explaining the data. However, a third model incorporating the features of both is capable of accounting for the observed behavior.

51971 (COO—1198-1267) **Interstitial-impurity trapping in Al—Fe and Al—Zn.** Hultman, K.L. (Illinois Univ., Urbana (USA). Dept. of Physics). 1979. Contract EY-76-C-02-1198. 147p. P 07/MF A01.

Ultrasonic attenuation and velocity measurements were made as a function of polarization, temperature, frequency and annealing before and after electron irradiation near 65°K of Al—Fe and Al—Zn dilute alloys. Multiple relaxation processes were observed in both alloys. In the case of Al—Zn, the simultaneous annealing near 130°K of resistivity, diaelastic modulus changes, and a paraelastic relaxation peak in C' allows for a characterization of the individual defects. The results provide strong evidence that below 130°K, the <100>-mixed dumbbell is the predominant interstitial trapping configuration. The temperature dependence of the relaxation peak near 4.9°K is not that expected for a thermally activated process, but provides evidence for defect tunneling. A second trapping configuration present in low concentration anneals out near 100°K, and probably arises from <111>-mixed defects. In Al—Fe, the observation of the diaelastic effect and a peak in the C' mode not previously seen in earlier internal friction measurements, together with an identification of this peak with the major defect species resolves the apparent contradiction between the internal friction and channeling symmetry evidence. This allows for an interpretation in terms of a <100>-mixed dumbbell which is consistent with previous theory and channeling and Moessbauer measurements. The results for Al—Fe differ greatly from those obtained earlier for Al—Mn, suggesting that current theories based only on size differences require extension.

51972 (COO—3158-61) **In-situ field—ion microscope study of the recovery behavior of ion-irradiated tungsten and tungsten alloys.** Wilson, K.L.; Baskes, M.I.; Seidman, D.N. (Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering). Apr 1979. Contract EY-76-S-02-3158. 40p. P 05/MF A01.

Five grades of W specimens with different purity levels were irradiated to a dose of typicaly 5 x 10^{12} ion cm^{-2} at 18°K. Examination with a low-temperature field-ion microscope showed the isochronal-annealing spectra of the specimens to result from a large self-interstitial atom (SIA) flux at ~ 38°K, followed by significant SIA flux from ~ 50 to 80°K and a small amount of additional recovery up to 120°K. The spectra for these specimens were essentially identical between 18 and 120°K. High-purity W specimens doped with C showed only a small reduction in the amount of recovery observed for the long-range migration peak at 38°K. The isochronal recovery spectra for W-Re specimens were different from the isochronal recovery spectra of pure W specimens. For both alloys the recovery of the Stage I long-range migration peak at 38°K was strongly suppressed. All recovery from 18 to 120°K was virtually eliminated indicating that during the long-range migration substage at 38°K tightly-bound, immobile SIA-Re complexes were formed that suppressed the SIA—SIA reaction. This effect was observed at high Re atom concentrations. The lack of any significant differences for the annealing spectra of the five purity-levels of undoped W and the appearance of impurity effects in the extremely concentrated alloys indicated that the early Stage II recovery observed in the annealing spectra of self-ion irradiated high-purity W was intrinsic. Because of the highly inhomogeneous SIA distribution of the W^+ ion damage, the SIA—SIA interaction during Stage I long-range migration at 38°K appeared to be the dominant trapping mechanism. The early Stage II SIA recovery was attributed to the migration or dissolution of these SIA clusters.

51973 (DOE/ET—0058/5, pp 24-35) **Precipitation response of 20%-cold-worked type 316 stainless steel irradiated in HFIR at 370 to 600°C.** Maziasz, P.J. (Oak Ridge National Lab., TN). 1979.

In Alloy development for irradiation performance. Quarterly progress report for period ending March 31, 1979.

The precipitation response of 20%-cold-worked type 316 stainless steel was examined after irradiation in HFIR at 380 to 600°C, afer irradiation in EBR-II at 500°C, and after thermal aging at 600 to 750°C. Eta phase is a major portion of the response during exposure to all environments. It is not normally reported in 20%-cold-worked type 316 stainless steel. Qualitatively eta phase, $M_{23}C_6$, Laves, sigma, and chi appear at similar temperatures after HFIR, EBR-II, or thermal exposure. However, relative amounts of phases, size, and distribution is the only carbide-type phase observed after irradiation in HFIR from 380 to 550°C. The large cavities associated with it at 380°C contribute significantly to swelling. Precipitate resolution and re-precipitation of massive particles of sigma, $M_{23}C_6$, and chi are observed after recrystallization in HFIR.

51974 (DOE/ET—0058/5, pp 79-91) **Microstructures of titanium scoping alloys following low-fluence neutron irradiation at 450°C.** Sprague, J.A.; Smidt, F.A. Jr. (Naval Research Lab., Washington, DC). 1979.

In Alloy development for irradiation performance. Quarterly progress report for period ending March 31, 1979.

The titanium scoping alloys Ti—6Al—4V (beta annealed), Ti-38-6-44,ad Ti-15-333 were examined by transmission electron microscopy (TEM) following irradiation in EBR-II to a fluence of 3.4 x 10^{21} neutrons/cm^2, E > 0.1 MeV, equivalent to 2.1 displacements per atom (dpa), at a temperature of 450°C. The principal microstructural changes observed in the Ti—6Al—4V were the formation of small dislocation loops and some nearly planar features identified as beta-phase precipitates in the alpha grains of the alloy. The Ti-38-6-44 and Ti-15-333, both of which are metastable beta alloys containing alpha-phase precipitates, both precipitated additional alpha phase during irradiation.

51975 (DOE/ET—0058/5, pp 92-103) **Comparison of the microstructure of titanium alloys after irradiation.** Sastry, S.M.L.; Davis, J.W.; O'Neill, J.E. 1979.

In Alloy development for irradiaton performance. Quarterly progress report for period ending March 31, 1979.

Postirradiation annealing studies of Ti—6Al—4V revealed that a temperature of 560°C was required for rapid annihilation of dislocations and dislocation loops. Similar tests on Ti-6242S showed that a temperature of 750°C was required to produce the same annealing effect found in Ti—6Al—4V. Annealing of the Ti-6242S at 750°C resulted in the formation of small beta precipitates in the primary alpha.

51976 (DOE/ET—0058/5, pp 104-113) **Ductility in bending of molybdenum alloys irradiated between 425 and 1000°C.** Wiffen, F.W.; Cox, B.L. (Oak Ridge National Lab., TN). 1979.

In Alloy development for irradiaton performance. Quarterly progress report for period ending March 31, 1979.

Irradiation of Mo, Mo-0.5% Ti, and TZM at 425 to 1000°C to fluences producing 11 dpa resulted in DBTTs in bending above room temperature for all irradiation temperatures. The most severe embrittlement was a DBTT between 550 and 700°C produced by irradiation at 585°C. Alloying at the concentrations in the two alloys tested had a relatively minor effect on the DBTT. For the two most embrittling irradiations, at 585 and 790°C, the alloys had lower DBTTs than did the unalloyed Mo. This may be related to the alloying raising grain boundary decohesion stress. The DBTT shift with irradiation temperature could not be quantitatively related to the observed microstructures.

51977 (HEDL-SA—1656) **Develop of the climb induced glide concept to describee in-reactor creep of FCC materials.** Chin, B.A.; Straalsund, J.L.; Gilbert, E.R. (Hanford Engineering Development Lab., Richland, WA (USA)). May 1979. Contract EY-76-C-14-2170. 21p. (CONF-790555—3). P 02/MF A01.

From International conference on fundamental mechanisms of radiation-Induced creep and growth; Chalk River, Canada (8 May 1979).

The Climb Induced Glide model (CIG) for irradiation creep is developed using a plastic flow law which has been successfully applied in the correlation of Type 316 stainless steel rupture data. This model is used to predict the stress and temperature dependence of irradiation creep and the transition from irradiation to thermal creep. The predictions of this model are compared and found to be qualitatively consistent with experimental data and microstructural information. This model allows prediction of deformation behavior covering strain rates from 1 x 10^{-13} sec^{-1} to 1 sec^{-1}.

51978 (WARD-AD—3045-9) **Particle redistribution and phase stability in ion and neutron irradiated gamma prime strengthened Fe—Cr—Ni based alloys.** Chang, A.L.; Baron, M. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). Jul 1979. Contract EY-76-C-02-3045-024. 24p. AT.

A series of Fe/15 wt % Cr/X wt % Ni γ'-strenghtened alloys, with X ranging from 25 to 45 wt %, were systematically investigated in both nickel ion and neutron irradiation conditions. The major phases in this class of alloys in the austenitic matrix are spherical γ' particles and some blocky MC carbides (mostly TiC). At grain boundaries, M_6C, $M_{23}C_6$, Laves phase (for silicon containing alloys) and cellular γ' were observed. In general, due to the enhanced point defect concentration under irradiation, enhanced growth kinetics of all these phases were observed. Solute redistribution and segregation to dislocations and voids were also evident. Evidence of γ' dissolution was observed after exposure to both nickel ion and neutron irradiations. The γ' particle redistribution behavior after both nickel ion and neutron irradiations was analyzed quantitatively in terms of the Baron—Chang—Bleiberg theory.

51979 **Defect trapping of ion-implanted deuterium in Fe.** Myers, S.M.; Picraux, S.T.; Stoltz, R.E. (Sandia Laboratories, Albuquerque, New Mexico 87185). *J. Appl. Phys.;* **50**: No. 9, 5710-5719(Sep 1979).

The trapping of ion-implanted deuterium (D) by lattice damage in Fe was investigated in the temperature range 90—500 K. The D depth profile was determined by measuring the proton yield from the ^{3}He-excited nuclear reaction D(^{3}He,p)^{4}He, and the D lattice location was obtained by ion channeling. Linear ramping of the temperature produced a sharp detrapping stage at 260 K and a broader release extending over 350—450 K. The release-vs-temperature data were analyzed by solving the diffusion equation with appropriate trapping terms, yielding 0.48 and ≅0.81 eV for the binding enthalpies associated with the two stages. The 0.48-eV trap corresponds to D at a near-octahedral interstitial site, where it is believed to be associated with a vacancy.

51980 **Role of divacancies in void swelling.** Yoo, M.H. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Scr. Metall.;* **13**: No. 7, 635-639(Jul 1979).

The effect of divacancies on the growth kinetics of dislocation loops and voids has been investigated by incorporating into the rate equations the reactions of vacancy association, divacancy dissociation, divacancy-interstitial interaction, and divacancy loss to unsaturable sinks. Based on the available defect parameters for fcc metals, it was found that the general role of divacancies in diffusion processes is most important in Al and Ni, moderately important in Cu and Ag, and not important in Au. Since the previous analysis was based on the parameters of monovacancies and divacancies from available self-diffusion data, it is worthwhile to examine the sensitivity of the divacancy role in void swelling under irradiation by varying divacancy parameters, such as the binding energy of divacancy, and the preference factor of dislocation for divacancies. The defect generation rate, G, was taken as a constant for both monovacancies and interstitials, and zero for divacancies in the previous paper which is the case for an electron irradiation situation. During neutron or heavy-ion irradiation, displacement damage cascades may produce an appreciable population of divacancies. Therefore, the effect on void swelling of the divacancy source from depleted zones created by displacement cascades is investigated.

CERAMICS, CERMETS, AND REFRACTORIES

REFER ALSO TO CITATION(S) 50984

PREPARATION AND FABRICATION

REFER ALSO TO CITATION(S) 51153, 51479

51981 (IBK—1442) **Investigation and development of UO_2 fuel pins in "Boris Kidric" Institute.** Stamenkovic, I.; Spasic, Z. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). 1977. 32p. (In Serbian). U 03/MF A01.

The main results of the investigations and development of UO_2 fuel and fuel pins obtained in βoris "Boris Kidric" Institute during last twelve years have been reviewed. The effects towards to be acquainted with UO_2 powders compressibility and sinterability, sintered bodies thermal expansion, electrical conductivity and microstructural properties were mentioned. The description of existing equipment and the essential operations as powders pretreatment, pressing, sintering, grinding, zirconium components characterization and welding were described shortly, also.

51982 (SAND—78-2294C) **CVD boride coatings for erosion applications.** Randich, E. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 4p. (CONF-790903—1). P 02/MF A01.

From 5. international conference on erosion by liquid and solid impact; Cambridge, UK (3 Sep 1979).

Chemical vapor deposition (CVD) coatings of TiB_2 and ZrB_2 have been obtained in the temperature range of 1073 to 1273 K. The coatings exhibit significantly improved erosion resistance when compared to the materials in their hot pressed forms. The reasons for the excellent erosion performance of the borides, as compared to cemented carbides or hot pressed materials, are examined and discussed. A successful application of CVD TiB_2, as a coating on a high pressure let-down valve stem in coal slurry service, is presented and discussed.

51983 **Sputter deposition of thin films of superconducting $Er(RhB)_4$.** Christner, G.L.; Bradford, B.; Toth, L.E.; Cantor, R.; Dahlberg, E.D.; Goldman, A.M.; Huang, C.Y. (School of Chemical Engineering and Materials Science). *J. Appl. Phys.;* **50**: No. 9, 5820-5822(Sep 1979).

Thin films of essentially single-phase $ErRh_4B_4$ have been sputter deposited from an arc-melted target of $ErRh_4B_4$ in an ultra-high-vacuum system incorporating a liquid-nitrogen cryogettering can. Optimum conditions for depositing the films were determined. The films exhibit reentrant superconducting transitions with T/sub c/'s somewhat different from those reported for bulk material.

51984 **Carbonado-type diamonds and polycrystalls of cubic boron nitride (β BN).** Yakovlev, E.N. (Inst. of High Pressure Physics, Moscow, USSR). pp 953-956 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

For a long time it was thought that there were only two ways of manufacturing diamonds: first, by growing the monocrystalls and second, by sintering diamond powder. The possibility of obtaining polycrystalline diamond and cubic boron nitride (β BN) by any other means was postulated as a result of the long-standing efforts. These efforts resulted in obtaining polycrystalline diamonds and polycrystalline cubic boron nitride. By the use of corresponding thermodynamic parameters, we were able to obtain strong fine-grained diamonds and polycrystalline cubic boron nitride stones with the structure of a carbonado-type diamond. The properties of these synthesized materials used for tools and high-pressure equipment are examined.

51985 **High-pressure synthesis of SmB_2 and GdB_{12}.** Cannon, J.F.; Cannon, D.M.; Hall, H.T. (Brigham Young Univ., Provo, UT). pp 1000-1006 of High-Pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Lattice parameters for NdB_6, SmB_6, GdB_6, and GdB_{12} are given and compared with literature values. Dodecarbide ThB_{12} was prepared and the diborides of Gd, Ho, and Tm were prepared. (FS)

51986 **New type of boron nitride sintered under very high pressure.** Sawaoka, A.; Saito, S. (Tokoyo Inst. of Tech., Japan); Araki, M. pp 986-993 of High-Pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Very hard materials with high ductility are very useful as high pressure anvils or cutting tools. Natural polycrystalline diamond, carbonado, has been used as a special drawing die. It is difficult to produce polycrystalline diamond without binder materials. Si or Co with other elements have a practical use as a binder. A composite of the zinc blende type boron nitride (z-BN) and tungsten carbide has been developed for cutting tools and is being used industrially. Since the hardness of z-BN is comparable to diamond and since it tends not to react with transition metals at high temperatures, polycrystalline z-BN without using a binder is a most useful material for cutting steel. Powder crystals of boron nitride z-BN were synthesized using a molten catalyst. This powder has a hard sinterable property. It is assumed that the singering is based on the phase transition from graphite-like boron nitride (g-BN) to z-BN under very high pressure. The direct conversion was first performed above 90 kbar and 1400°C, with a conversion ratio less than 30%. The pressure and temperature were lowered to around 60 kbar and 1200°C, by using poorly crystallized g-BN. A very hard sintered compact of z-BN having a Vickers hardness of 6500 kg/mm^2 was produced. The phase relations between w-BN and z-BN, the mechanical properties, and microstructure of sintered compacts having wurtzite, zinc blende, and the mixture phases are reported.

STRUCTURE AND PHASE STUDIES

REFER ALSO TO CITATION(S) 51985, 51986, 51999

51987 **Water Hugoniot measurements in the range 30 to 220 GPa.** Mitchell, A.C.; Nellis, W.J. (Univ. of California, Livermore). pp 428-434 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Shock Hugoniots of H_2O, NH_3, CH_4, and also D_2, since hydrogen is a major constituent of Jupiter and Saturn, were measured in order to refine the equation of state data base for planetary modeling. New data which fills the gap in the water Hugoniot data between the 45 GPa and 100 GPa is presented. In addition, data from a double-shock experiment extends the highest pressure of water Hugoniot abolute measurements by a factor of approximately 2.

MECHANICAL PROPERTIES

REFER ALSO TO CITATION(S) 50977, 51482, 51612, 51616, 51626, 51986

51988 (UCRL—82614) **Elastic and plastic properties of uranium dioxide from 5 to 330 GPa.** Gust, W.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 May 1979. Contract W-7405-ENG-48. 20p. (CONF-790709—3). P 02/MF A01.

From VII international AIRAPT conference; La Creusot, France (30 Jul 1979).

Published Hugoniot data for UO_2 is in error, because the measuring techniques used did not resolve the strong multiple-wave shock-structures present. Hence calculations related to liquid metal, fast-breeder-reactor, excursion analyses based on extrapolations of that data are in serious error. The inclined prism, flash gap, and two-stage gas-gun techniques are used to determine shock-compression parameters for UO_2 to 300 GPa. The Hugoniot elastic limit for UO_2 was found to be 5.7 GPa. At higher pressure, a plot of shock vs particle velocity displays a discontinuity between 1.0 < U/sub p/ < 1.8 km/s, which appears to be a manifestation of a solid-solid phase transition. For 1.8 < U/sub p/ < 4.0 km/s, the plot is given by U/sub s/ = 5.8 + 1.28 (U/sub p/ - 1.8).

51989 **Use of new synthetic polycrystalline materials—carbonado-type diamond and cubic boron nitride.** Konyaev, Yu.S. (Inst. of High Pressure Physics, USSR Academy of Sciences, Moscow, USSR). pp 957-962 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

The design of tools using synthetic superhard materials that allow operation with minimum cutting forces and maximum dimensional stability is one of the main trends in improving the precision and quality of machining. Usually only abrasive tools have been made of synthetic superhard materials based on diamond and cubic boron nitride. The abrasive tool is used in machining hard alloys, tempered steels, and various hard-to-work alloys. However, the entire problem of the precision working of machine parts cannot be solved by using abrasive tools alone - a bladed tool of superhard materials is needed. The synthesis of polycrystalling carbonado-type diamonds has opened up the possibility of creating new types of metalworking, drilling, and stoneworking tools. The outstanding properties of the diamonds that have been developed also have made it possible to use them with greater effectiveness on materials that did not previously submit to cutting.

51990 Effect of pressures up to 2.0 GPa on the mechanical properties of tungsten carbide. Brew, P.A.; Crossland, B. (The Queen's Univ. of Belfast, N. Ireland). pp 559-566 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

After a brief review of the known properties and uses of tungsten carbide, stress/strain data at pressure to 2 GPa and temperatures up to 600°C were studied.

PHYSICAL PROPERTIES

REFER ALSO TO CITATION(S) 51653, 51836, 51983

51991 (BNL—26442) **Experimental study of induced staggered magnetic fields in dysprosium gallium garnet (DGG).** Steiner, M.; Corliss, L.M.; Hastings, J.M.; Blume, M.; Giordano, N.; Wolf, W.P. (Brookhaven National Lab., Upton, NY (USA); Yale Univ., New Haven, CT (USA). Dept. of Engineering and Applied Science). 1979. Contract EY-76-C-02-0016. 7p. (CONF-790909—3). P 02/MF A01.

From International conference on magnetism; Munich, F.R. Germany (Sep 1979).

Neutron diffraction techniques have been used to study induced staggered magnetic field effects in DGG. The application of a uniform magnetic field at temperatures much greater than the Neel temperature induces a significant amount of antiferromagnetic order. The temperature and field dependences of this effect are in good agreement with recent theoretical predicions.

51992 (COO—4451-2) **Electrolytic degradation of lithia-stabilized β''-alumina. Technical progress report, May 1, 1978—March 31, 1979.** Virkar, A.V. (Utah Univ., Salt Lake City (USA). Dept. of Materials Science and Engineering). Apr 1979. Contract EG-77-S-02-4451. 71p. P 04/MF A01.

Research activities are described concerning fabrication of β'' alumina specimens in the bar and tube geometries; construction and opertion of Na—β'' cells and the effect of cell temperature on the degradation of β'' alumina, cell design and role of impurities in β''-alumina-($NaNO_3$—$NaNO_2$) cell; effect of grain size on degradation; effect of K on degradation and fracture studies. It has been found that degradation of Na—Na cells is just above and below the melting point of Na, wetting is important, and fine grained ceramics degrade easier. (FS)

51993 (EUR—5443) **Results of measurements of the thermal contact conductance.** Arrighi, J.; Daniele, F. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1977. 28p. U 03/MF A01.

Contact heat transfer between solid surfaces is a major operating factor in such systems as bearings, switching contacts and reactor fuel element claddings. In some instances it may become a controlling design parameter. Study and comparison of the correlations showed an uncertainty of at least one order of magnitude for the thermal conductance of surfaces in contact. A set of experiments related directly to the problem of thermal distribution in a Sandvik 1.4981 steel-clad UO_2 element was carried out in flat geometry to obtain necessary data for reactor designers. The correlations obtained in the present study are thought to enable the designer to assess a contact conductance value within +-30% of the actual value with a good confidence level.

51994 (LA-UR—79-1750) **Microprobe field measurements in $ErRh_4B_4$.** Taylor, R.D.; Willis, J.O. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 9p. (CONF-790653—8). P 02/MF A01.

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

A small hyperfine field at Fe impurity sites in $ErRh_4B_4$ at 0.38 K was observed. The magnitude of the field at the nonmagnetic impurity sites was 0.5 T. This hyperfine field reflects spin order at the Er sites but the sensitivity of the probe technique employed turned out to be marginal for investigating quantitatively the shape of the ordering curve with temperature near and below T/sub c2/.

51995 (SAND—78-2444C) **Investigations of the effect of the morphology of Nb dopant on lead zirconate ceramic.** Keck, J.D.; Wilcox, P.D. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 8p. (CONF-790670—2). P 02/MF A01.

From IEEE international symposium on application of ferroelectric; Minneapolis, MN, USA (13 Jun 1979).

The microstructures of ferroelectric ceramics are a result of the dopants and of the many process variables associated with raw materials, powder processing, and ceramic firing. Metal ion substitutions of higher than normal valency are used as sintering aids to promote densification, to increase electrical resistivity, and to develop mature homogeneous microstructures with desirable piezoelectric and ferroelectric properties. Investigations are reported for the barium modified lead zirconate system which is analogous to the lead zirconate titanate system, in which Nb is used as a sintering aid. The morphology and concentration of the Nb are shown to affect both electrical properties and the microstructure.

51996 Photon-stimulated desorption of ions. Knotek, M.L.; Jones, V.O.; Rehn, V. (Sandia Laboratories, Albuquerque, New Mexico 87185). *Phys. Rev. Lett.;* **43**: No. 4, 300-303(23 Jul 1979).

We report photon-stimulated desorption (PSD) of ions by the same core-hole Auger-decay mechanism observed in electron-stimulated desorption (ESD). Ions desorbed by synchrotron radiation were identified by time-of-flight mass spectroscopy. The thresholds for the PSD and ESD of H^+, OH^+, and F^+ from TiO_2 are identical. The PSD excitation spectra consists of sharp peaks, compared to broad steps in ESD. PSD is shown to be a powerful surface probe with the potential of providing unique information on bonding sites.

51997 Electronic structure of homoleptic transition metal hydrides: TiH_4, VH_4, CrH_4, MnH_4, FeH_4, CoH_4, and NiH_4. Hood, D.M.; Pitzer, R.M.; Schaefer III, H.F. (Department of Chemistry and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *J. Chem. Phys.;* **71**: No. 2, 705-712(15 Jul 1979).

Ab initio molecular electronic structure theory has been applied to the family of transition metal tetrahydrides TiH_4 through NiH_4. For the TiH_4 molecule a wide range of contracted Gaussian basis sets has been tested at the self-consistent-field (SCF) level of theory. The largest basis, labeled M(14s 11p 6d/10s 8p 3d), H(5s 1p/3s 1p), was used for all members of the series and should yield wave functions approaching true Hartree-Fock quality. Predicted SCF dissociation energies (relative to M+4H) and M—H bond distances are TiH_4 132 kcal, 1.70 A; VH_4 86 kcal, 1.64 A; CrH_4 65 kcal, 1.59 A; MnH_4 — 36 kcal, 1.58 A; FeH_4 0 kcal, 1.58 A; CoH_4 27 kcal, 1.61 A; and NiH_4 18 kcal, 1.75 A. It should be noted immediately that each of these SCF dissociation energies will be increased by electron correlation effects by perhaps as much as 90 kcal. For all of these molecules except TiH_4 excited states have also been studied. One of the most interesting trends seen for these excited states is the shortening of the M—H bond as electrons are transferred from the antibonding $4t_2$ orbital to the nonbonding 1e orbitals.

51998 Optical and electrical properties of ZnO films prepared by spray pyrolysis for solar cell applications. Aranovich, J.; Ortiz, A.; Bube, R.H. (Department of Materials Science and Engineering, Stanford University, Stanford, California 94305). *J. Vac. Sci. Technol.;* **16**: No. 4, 994-1003(Jul 1979).

Zinc oxide films were produced by spray pyrolysis starting with aqueous solutions of $ZnCl_2$, $ZnCl_2$ plus H_2O_2, and Zn acetate, and structural, optical, electrical, and thermoelectrical properties of the deposited films were investigated. Highly transparent films with resistivity as low as 10^{-3} Ω cm can be produced by suitable control of deposition procedures and by postdeposition annealing in hydrogen.

51999 Electrical response of shock-wave-compressed ferroelectrics. Lysne, P.C. (Sandia Labs., Albuquerque, NM). pp 202-209 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

An analysis is made of normal mode devices working into general electrical loads and illustrating the normal mode concepts by experimenting on phase transformations of ferroelectric ceramics. Material parameters of importance are resistivity, instantaneous and related dielectric permittivities, and the associated dielectric relaxation time. (FS)

52000 Thermal conductivity of polycrystalline cubic boron nitride compacts. Corrigan, F.R. (General Electric Co., Worthington, OH). pp 994-999 of High-Pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Natural isotope abundance polycrystalline cubic BN compacts prepared by direct high-pressure/high-temperature conversion of graphitic BN and having room temperature thermal conductivity values up to a factor of four higher than previously reported are discussed.

52001 Chemically reacting SiO_2, H_2O, and SiO_2 + H_2O systems under high pressure and temperature. Ree, F.H. (Univ. of California, Livermore). pp 135-143 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Dynamic physical processes are simulated with a computer, using the equation of state (EOS) for the materials in question. The more accurate the equation of state, the closer the program can simulate the physical reality. The equation of state expressions for silicon dioxide (SiO_2), water (H_2O), and $SiO_2 + H_2O$ mixture were obtained. Such expressions are of primary interest to the designers of underground nuclear tests because cavity size, pressure, and other seismic disturbances of the explosion depend on the state properties of rock media. A rather crude EOS expression (such as an ideal-gas law) has been used to satisfy an actual need. To remedy this situation, the equation of state expressions that are applicable over a large (rho, T) range were developed by using several theoretical models that describe various physical processes appropriate for different regions of rho and T. A low-rho (less than or equal to rho_0) and low-T (less than or equal to 1 eV) portion of the region are studied. [T (really kT) in eV is equal to 11605.5T (in Kelvin).] This is a relatively unexplored but physically interesting region, where thermodynamics are governed by chemical reactions and phase changes.

CORROSION AND EROSION

REFER ALSO TO CITATION(S) 51836, 51982

RADIATION EFFECTS

52002 (EUR—5906) **Report on swelling of MX-type fuels 1973/76: self-diffusion in MX-type nuclear fuels out-of-pile and in-pile.** Matzke, H.; Bradbury, M.H. (Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). 1978. 111p. U 06/MF A01.

Self-diffusion measurements of Pu-238 and U-233 have been carried out in a wide range of advanced nuclear fuels in the temperature region from 1200 to 2300°C. The materials studied varied in composition from carbides through carbonitrides to nitrides. In particular the effect on self-diffusion rates of factors such as non-metal/metal ratio, oxygen content increasing nitrogen contents, metallic impurity additions, the presence of second phases and fission products simulating 16, 10 and 3 a /o burn up has been established. Grain boundary diffusion rates were evaluated where possible. Carbon diffusion in stoichiometric and off-stoichiometric UC and in a series of uranium carbonitride samples was also measured. The RADIF experiments (radiation induced diffusion) have provided results upon the effect of irradiation on the self-diffusion rates in the temperature range 150 to 1300°C. Each of the factors mentioned above is discussed in detail with special attention being given to the effects of non-metal/metal ratio, impurities and increasing the nitrogen content in carbonitride materials.

52003 (EUR—5907) **Measurements and observations on microscopic swelling in MX-type fuels.** Ronchi, C.; Ray, I.L.F.; Thiele, H.; van de Laar, J. (Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). 1978. 56p. U 04/MF A01.

Microscopic swelling has been investigated by electron microscopy in several MX-type fuels, irradiated in fast and thermal neutron flux. The results show that fission gas bubbles in these compounds grow to large sizes if the in-pile fuel temperature rises above a critical value (swelling critical temperature Tsub(C)). A comparison has been made of the swelling rates in fuels of different composition, showing that Tsub(C) increases from carbides to nitrides. In fuels subjected to in-pile restructuring (highly rated) He-bonded pins microscopic swelling is affected by pore and grain boundary migration. The influence of these phenomena on the fuel swelling performance has been discussed.

52004 (EUR—5971) **Calculation of oxygen distribution in uranium-plutonium oxide fuels during irradiation (programme CODIF).** Moreno, A.; Sari, C. (Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). 1978. 23p. U 03/MF A01.

Radial gradients of oxygen to metal ratio, O/M, in uranium-plutonium oxide fuel pins, during irradiation and at the end of life, have been calculated on the basis of solid-state thermal diffusion using measured values of the heat of transport. A detailed computer model which includes the calculation of temperature profiles and the variation of the average O/M ratio as a function of burn-up is given. Calculations show that oxygen profiles are affected by the isotopic composition of the fuel, by the temperature profiles and by fuel-cladding interactions.

COMPOSITE MATERIALS

MECHANICAL PROPERTIES

REFER ALSO TO CITATION(S) 51512

52005 (COO—3084-68) **Approximate method for the estimate of the contribution of load transfer to the internal stress in dispersed particles.** Gurland, J. (Brown Univ., Providence, RI (USA). Div. of Engineering). Jun 1979. Contract EY-76-S-02-3084. 4p. P 02/MF A01.

The derivation of an approximate expression for the contribution of load transfer to the internal stress in hard particles dispersed in a plastic matrix is a part of a theoretical model, for structural phase continuity and its effect on the yield strength of two-phase alloys. This elaboration and expansion of one aspect of the model will first define the pertinent average geometric characterization of the particles and then consider the average stress in a representative particle of average dimensions.

POLYMERS AND PLASTICS

MECHANICAL PROPERTIES

REFER ALSO TO CITATION(S) 51233, 51293

52006 Influence of curing agent concentration and curing temperatures on the thermostability of styrene—acrylonitrile—acrylamide—trimethylolpropane trimethacrylate copolymer systems. Zeldin, A.N.; Kukacka, L.E.; Fontana, J.J.; Carciello, N.R.; Reams, W. (Brookhaven National Lab., Upton, NY). *J. Appl. Polym. Sci.;* **24**: No. 2, 455-464(15 Jul 1979).

Thermogravimetric (TGA) and infrared (IR) analyses were used to determine the thermal stability of a polymer system consisting of styrene—acrylonitrile—acrylamide—trimethylolpropane trimethacrylate. This study indicates that increases in curing temperature and the use of two initiators with different activities decreases the percentages of unreacted monomers. This increases the thermal stability of the polymer. To prove this, dynamic and isothermal TGA were used. The change in typical functional groups found by IR spectra also confirms this observation. 7 figures, 2 tables.

PHYSICAL PROPERTIES

REFER ALSO TO CITATION(S) 51293, 51755

OTHER MATERIALS

PREPARATION AND MANUFACTURE

REFER ALSO TO CITATION(S) 51234, 51236, 51238, 51239, 51241, 51242, 51243, 51252, 51260, 51984, 52123

52007 (COO—4929-3) **Use of precalciners to remove alkalies from raw materials in the cement industry. Quarterly technical progress report, February—April 1979.** Gartner, E.M. (Portland Cement Association, Skokie, IL (USA)). May 1979. Contract EM-78-C-02-4929. 14p. P 02/MF A01.

Laboratory tests designed to evaluate the volatility of alkalies in finely-ground argillaceous minerals are reported. A method used to determine the sintering points of these minerals is described. In addition to six pure minerals which were studied, argillaceous materials which are more typical of cement-plant raw feed components were studied. The conclusions of this report are: at 1000°C, a combination of $CaCO_3$ and $CaCl_2$ additives enables volatilizion in one-half hour up to about 50% of the total alkali from high-alkali feldspars. However, much less alkali was lost from the typical cement plant raw materials under the same conditions; the atmosphere in which the experiment was conducted may have a significant effect on the results, especially if there is S present in the system. Absence of O can lead to decomposition ofnormally involatile alkali sulfates. Fe Cl_3, may be lost from the sample. Losses are greatest in the absence of CaO and water vapor; sintering points of the pure minerals are above 1200°C. Therefore, there is little danger of their sintering at 1000°C, the presence of fluxing agents such as $CaCl_2$ may cause some sticking: and the use of vapor-phase compounds such as $FeCl_3$ and HCl is not an effective means of volatilizing alkalies under test conditions of (1000°C for 30 minutes).

52008 (COO—5011-1) **Sulfate specifications as a constraint to gypsum addition to cement and possible replacement of gypsum as an additive. Quarterly technical progress report, September—October—November 1978.** Kantro, D.L. (Portland Cement Association,

Skokie, IL (USA). Construction Technology Labs.). Nov 1978. Contract EW-78-C-02-5011. 5p. P 02/MF A01.

Preparation and acquisition of working materials occupied most of the time expended. Calorimetric studies have been initiated.

52009 (COO—5011-2) **Sulfate specifications as a constraint to gypsum addition to cement and possible replacement of gypsum as an additive. Quarterly technical progress report, December 1978—January—February 1979.** Kantro, D.L. (Portland Cement Association, Skokie, IL (USA). Construction Technology Labs.). Feb 1979. Contract EW-78-C-02-5011. 8p. P 02/MF A01.

The objectives of the contract project are to develop comprehensive data on: (1) potential alternatives to gypsum for controlling set in commercial concretes; (2) additives to deter sulfate-induced expansion; and (3) the influence of clinker manufacturer on expansion potential in cements. This data will provide a basis for reconsidering the limitations currently imposed on sulfate contents in cements for reasons of soundness.

52010 Electrical and structural characteristics of laser-induced epitaxial layers in silicon. Young, R.T.; Narayan, J.; Wood, R.F. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Appl. Phys. Lett.;* **35**: No. 6, 447-449(15 Sep 1979).

We have used pulsed-laser radiation to grow homoepitaxial p-n junctions in silicon. Doped amorphous silicon was deposited on (100) and (111) silicon substrates and annealed with a Q-switched ruby laser. By this technique, perfect epitaxial layers with good electrical characteristics and controlled dopant profiles can be achieved. The technique can potentially be competitive with or replace ion implantation for many semiconductor-device applications.

STRUCTURE AND PHASE STUDIES

REFER ALSO TO CITATION(S) 51482, 52029

52011 Theoretical Compton profile anisotropies in molecules and solids. IV. Parallel—perpendicular anisotropies in alkali fluoride molecules. Matcha, R.L.; Pettitt, B.M.; Ramirez, B.I.; McIntire, W.R. (Department of Chemistry, University of Houston, Houston, Texas 77004). *J. Chem. Phys.;* **71**: No. 2, 991-996(15 Jul 1979).

Calculations of Compton profiles and parallel—perpendicular anisotropies in alkali fluorides are presented and analyzed in terms of molecular charge distributions and wave function character. It is found that the parallel profile associated with the valence pi orbital is the principal factor determining the relative shapes of the total profile anisotropies in the low momentum region.

PROPERTIES

REFER ALSO TO CITATION(S) 51167, 51233, 51234, 51237, 51260, 51837, 51954, 51989, 51991, 52121

52012 (GA-A—15495) **Strength of irradiated graphite: a review.** Price, R.J. (General Atomic Co., San Diego, CA (USA)). Jul 1979. Contract EY-76-C-03-0167. 15p. (CONF-7906105—1). P 02/MF A01.

From Meeting on mechanical behavior of graphite for high temperature reactors; Gif-sur-Yvette, France (11 Jun 1979).

Experimental data on the mechanical strength of nuclear graphite subjected to fast neutron irradiation are reviewed. At fluences below the turnaround point, the mean tensile, flexural, or compressive strength, S, increases over the unirradiated value, S_0, in a manner related to the irradiation-induced change in Young's modulus, E: $S/S_0 = (E/E_0)/\text{sup } K/$. The exponent, k, takes a value between 0.5 and 1, depending on the graphite grade, the irradiation temperature, and the method used for determining E. A value of 0.5 for k would be expected from the Griffith—Irwin theory of fracture if neither the critical flaw size nor the effective surface energy of a crack is altered by irradiation; a value of 1 would be expected if the strain at failure remains constant. At higher fluences, when expansion starts, strength values decrease. The effect of irradiation on the statistical spread of the strength measurements depends on the graphite grade and the neutron fluence. At fluences below the turnaround point, the coefficient of variation of strength determinations for standard reactor grades is little changed, but at higher fluences, and for fine-grained, high strength materials, the coefficient of variation may increase. Although specimens for different locations in a graphite log, or from different logs of the same grade, vary in strength, under the same conditions of irradiation the fractional increase in strength of these specimens will be similar. After irradiation, graphite appears to have a slightly greater resistance to cyclic fatigue, as measured by the homologous stress limits for survival to a specified number of cycles.

52013 X-ray diffraction study of liquid tertiary butyl alcohol at 26 °C. Narten, A.H.; Sandler, S.I. (Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *J. Chem. Phys.;* **71**: No. 5, 2069-2073(1 Sep 1979).

The x-ray diffraction pattern of liquid tertiary butyl alcohol (CMe_3OH) near the melting point has been measured. The data are analyzed to yield the molecular structure. The distinct structure function H/sub d/(k) derived from the data is compared with that obtained previously for liquid neopentane (CMe_4). The replacement of one methyl group in CMe_4 by a hydroxyl group to produce CMe_3OH results in significant changes in H/sub d/(k). The data show clearly that hydrogen-bonded hydroxyl groups occur in liquid CMe_3OH with an OxxxO distance of 2.74 A, and that each hydroxyl group has two nearest neighbors at this distance.

52014 Carbon-13 NMR of carbon monoxide. II. Molecular diffusion and spin—rotation interaction in liquid CO. Fukushima, E.; Gibson, A.A.V.; Scott, T.A. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *J. Chem. Phys.;* **71**: No. 4, 1531-1536(15 Aug 1979).

Carbon-13 NMR was used to measure the molecular diffusion coefficient D and the spin-rotation correlation time tau/sub s/r in liquid CO from its freezing point to about 110 K at several pressures up to 1.73 kbar. The behavior of D and tau/sub s/r is similar for liquid CO and N_2. Diffusion in CO at equilibrium vapor pressure takes place with an activation enthalpy of 2.9 kJ/mole and its pressure dependence leads to an activation volume which is a factor of 5 smaller than in the solid phase just below freezing. tau/sub s/r is nearly equal for CO and N_2 at T< or =80 K and its variation with pressure for CO is smaller than that of D by almost a factor of 2. We also present a method for determining the magnetic field gradient used in the measurement of D which is free from many of the usual problems.

52015 Effects of pressure on the dielectric properties and phase transitions of the 2-D antiferroelectric squaric acid: ($H_2C_4O_4$ and $D_2C_4O_4$). Samara, G.A.; Semmingsen, D. (Sandia Laboratories, Albuquerque, New Mexico 87185). *J. Chem. Phys.;* **71**: No. 3, 1401-1407(1 Aug 1979).

The pressure dependences of the dielectric properties and phase transitions of squaric acid, $H_2C_4O_4$, and its deuterated analog, $D_2C_4O_4$, were investigated. The transition temperatures at 1 bar are 375.5 +- 1.0 K and 527.5 +- 2.0 K, respectively, and decrease with pressure at initial rates of 105.6 +- 2.0 K/GPa and 102.5 +- 2.0K/GPa. It is argued that the large hydrogen isotope effect on T/sub c/ can be accounted for on the basis of the elongation of the O—HxxxO bond resulting from deuteration. This elongation causes a modification of the double-well potential along this bond. It is not necessary to invoke proton tunneling. The lack of an appreciable isotope effect on dT/sub c//dP supports the absence of tunneling. An interesting aspect of the results is the appearance of a dome-shaped feature in the real part of the dielectric constant just above T/sub c/ in both crystals. This feature, which is reminiscent of the behavior of the magnetic susceptibility of antiferromagnets above the Neel temperature, is discussed. The results on $D_2C_4O_4$ suggest the possible existence of a pressure-induced phase transition at ~0.8 GPa. The dielectric loss of this crystal is large both below and above T/sub c/. This is attributed to the high conductivity of $D_2C_4O_4$ on approaching the melting (or dissociation) temperature. The activation energies for conduction and their pressure dependences both above and below T/sub c/ are determined and discussed.

52016 Response behavior of the two-chain Fermi gas. Klemm, R.A. (Ames Laboratory—USDOE and Department of Physics, Iowa State University, Ames, Iowa 50011). *Phys. Rev., B: Condens. Matter;* **20**: No. 3, 823-849(1 Aug 1979).

A model of TTF-TCNQ (tetrathiafulvaleniumtetracyanoquinodimethanide) and similar charge-transfer linear conductors in which there are two chains are considered. The electrons on the acceptor (TCNQ) chains have a usual metallic band, but the electrons on the donor (TTF) chains have an inverted or "hole" band. The electrons on each chain interact via the forward and backward scattering g_2 and g_1 processes. Electrons on different chains interact via the analogous processes W_2 and W_1. The model is also applicable to two metallic chains, with the signs of W_1 and W_2 reversed.These results are discussed in conjunction with the previous renormalization-group treatment, which indicates that for certain values of g_2, W_2, and W_1 the line $g_1=0$ may be crossed. The results are used to interpret recent x-ray data on TTF-TCNQ showing a crossover from 4k/sub F/ to 2k/sub F/ behavior above the crossover from one-dimensional to three-dimensional behavior.

52017 Electronic structure of CuCl. Zunger, A.; Cohen, M.L. (Department of Physics, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Phys. Rev., B: Condens. Matter;* **20**: No. 3, 1189-1193(1 Aug 1979).

The electronic band structure of zinc-blende CuCl is computed using a self-consistent, first-principles, all-electron approach. The calculated energy levels agree with photoemission results and support a minimum-direct-gap interpretation of the optical data. Con-

trary to the indirect model proposed by Rusakov and used by Abrikosov to explain superdiamagnetism and/or high-temperature superconductivity, the calculated band-pressure coefficients do not yield an indirect gap at the pressure where anomalies appear.

52018 Diffusion coefficients for Br_2 in NO and Br in Ar at 298 °K. Zittel, P.F.; Little, D.D. (Chemistry and Physics Laboratory, The Ivan A. Getting Laboratories, The Aerospace Corporation, Los Angeles, California 90009). *J. Chem. Phys.;* **71**: No. 2, 723-735(15 Jul 1979).

A two-step laser photodissociation technique was used to generate Br atoms in NO or Ar mixtures. Time resolved mass spectrometric detection of Br_2, formed by fast homogeneous recombination in the NO mixtures, or by a heterogeneous wall reaction in the Ar mixtures, led to a determination of diffusion coefficients for Br_2 in NO and for Br in Ar at 298 °K. The reported values are D/sub Br/2-/sub NO/ = (0.11 +- 0.01) cm^2/sec and D/sub BrendashAr/= (0.21 +- 0.04) cm^2/sec at 1 atm. General solutions to the diffusion and heterogeneous reaction equations for the geometry of this experiment are presented.

52019 High pressure studies of electronic phenomena. Drickamer, H.G. (Univ. of Illinois, Urbana). pp 1-18 of High-pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

The basic effect of pressure is to decrease interatomic distance and increase overlap between adjacent electronic orbitals. As a consequence, any one type of orbital will shift in energy with respect to other types of orbitals. Much information can be extracted from this phenomenon. It is convenient to consider it in three categories: characterization of electronic states, electronic excitations or molecular conformations; perform critical tests of theories; and induce electronic transitions - new ground states with different physical or chemical properties. Examples are presented in each of these categories, selected to show how broadly useful high pressure studies of electronic phenomena can be in many areas of science.

CORROSION, EROSION, AND DEGRADATION

REFER ALSO TO CITATION(S) 51695, 52000

52020 (ORNL/SUB—7556/1) **Assessment of the corrosiveness of cellulosic insulating materials.** Weil, R.; Graviano, A. (Oak Ridge National Lab., TN (USA)). Jun 1979. Contract W-7405-ENG-26. 32p. P 03/MF A01.

A discussion of the information which is available about the corrosiveness of cellulose and other related properties is presented. A survey of the literature dealing with the corrosiveness of wood products other than cellulose and of the corrosiveness in other media by fire-retardant chemicals generally used with cellulosic insulation is included. The types of corrosion which could be caused by cellulosic insulation are briefly discussed.

RADIATION EFFECTS

REFER ALSO TO CITATION(S) 51472, 52012

52021 (GA-A—15270) **Property changes in graphite irradiated at changing irradiation temperature.** Price, R.J.; Haag, G. (General Atomic Co., San Diego, CA (USA); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Jul 1979. Contract AT03-76ET35300. 42p. P 03/MF A01.

Design data for irradiated graphite are usually presented as families of isothermal curves showing the change in physical property as a function of fast neutron fluence. In this report, procedures for combining isothermal curves to predict behavior under changing irradiation temperatures are compared with experimental data on irradiation-induced changes in dimensions, Young's modulus, thermal conductivity, and thermal expansivity. The suggested procedure fits the data quite well and is physically realistic.

52022 (SAND—79-0169C) **Radiation-induced frequency transients in AT, BT, and SC cut quartz resonators.** Koehler, D.R. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 21p. (CONF-790554—1). P 02/MF A01.

From 33. annual symposium on frequency control; Atlantic City, NJ, USA (30 May 1979).

Earlier studies of transient frequency changes in high-purity swept AT quartz resonators led to the conclusion that impurity-induced effects were small, while the observed changes were qualitatively and quantitatively well characterized in terms of the time changing temperature of the vibrating quartz and its effect on frequency. 5 MHz, AT cut fifth overtone, and BT and SC cut third overtone resonators were prepared from a single stone of Sawyer swept Premium-Q quartz. The resonators were operated in precision ovenized oscillators at or near their turnover temperatures. Pulsed irradiation, at dose levels of the order of 10^4 rads (Si) per pulse, was accomplished at Sandia. The experimental data display negative frequency transients for the AT cut resonators, positive frequency transients for the BT cut resonators, and very small transient effects for the SC cut resonators. From these experimental results, it is concluded that no measurable impurity-induced frequency changes are observed in this high-purity swept-quartz and that the frequency transients are accurately modelled in terms of transient temperature effects stemming from the thermal characteristics of the resonator structure.

CHEMISTRY

ANALYTICAL AND SEPARATIONS CHEMISTRY

REFER ALSO TO CITATION(S) 51036

ACTIVATION AND NUCLEAR REACTION PROCEDURES

REFER ALSO TO CITATION(S) 52154

CHEMICAL PROCEDURES

REFER ALSO TO CITATION(S) 51187

RADIOMETRIC AND RADIOCHEMICAL PROCEDURES

REFER ALSO TO CITATION(S) 51185, 52194

52023 Triosmium cluster compounds containing isocyanide and hydride ligands. Crystal and molecular structures of (μ-H)(H)$Os_3(CO)_{10}$(CN-t-C_4H_9) and (μ-H_2)$Os_3(CO)_9$(CN-t-C_4H_9). Adams, R.D.; Golembski, N.M. (Yale Univ., New Haven, CT). Contract ER-78-S-02-4900. *Inorg. Chem.;* **18**: No. 7, 1909-1912(Jul 1979).

The structures of the compounds (μ-H)(H)$Os_3(CO)_{10}$(CN-t-C_4H_9) and (μ-H_2)$Os_3(CO)_9$(CN-t-C_4H_9) have been revealed by x-ray crystallographic techniques. For (μ-H)(H)$Os_3(CO)_{10}$(CN-t-C_4H_9): a = 9.064 (3), b = 12.225 (3), c = 20.364 (4) A; β = 98.73 (3)°, space group $P2_1/c$[C/sub 2h/^{5}], No. 14; Z = 4; d/sub calcd/ = 2.79 g cm^{-3}. This compound contains a triangular cluster of three osmium atoms; Os(1)—Os(2) = 2.930 (1) A, Os(1)—Os(3) = 2.876 (1) A, and Os(2)—Os(3) = 3.000 (1) A. There are ten linear terminal carbonyl groups and one linear terminal isocyanide ligand which occupies an axial coordination site. The hydrogen atoms were not observed crystallographically, but their positions are strongly inferred from considerations of molecular geometry. For (μ-H_2)$Os_3(CO)_9$(CN-t-C_4H_9): a = 15.220 (8), b = 12.093 (6), c = 23.454 (5) A; space group Pbcn [D/sub 2h/^{14}], No. 60; Z = 8; d/sub calcd/ = 2.79 g cm^{-3}. The compound is analogous to the parent carbonyl (μ-H_2)$Os_3(CO)_{10}$ and has two normal and one short osmium—osmium bonds: Os(1)—Os(2) = 2.827 (1) A, Os(1)—Os(3) = 2.828 (1) A, Os(2)—Os(3) = 2.691 (1) A. The isocyanide ligand resides in an equatorial coordination site on osmium Os(2). The hydrogen atoms were not observed but are believed to occupy bridging positions as in the parent carbonyl complex. 2 figures, 7 tables.

SPECTRAL PROCEDURES

REFER ALSO TO CITATION(S) 51035, 51119, 52039, 52051

52024 (SAND—79-0968) **Quantitative gas analysis using Fourier transform infrared spectroscopy.** Rivord, G.E. (Sandia Labs., Albuquerque, NM (USA)). Jul 1979. Contract EY-76-C-04-0789. 27p. P 03/MF A01.

Experimental methods have been developed for quantitative trace gas analysis using the Nicolet 7199 Fourier transform infrared (FTIR) spectrophotometer. High resolution (0.06 cm^{-1} full width - half maximum) spectra were obtained for CO and N_2O at ~ 1000, 100, and 5 ppM and CO_2 at ~ 1000 ppM. These spectra were used to test the quantitative accuracy of the Beer—Lambert relationship and the linearity of the FTIR system. Two methods were used to analyze the spectra. The first involved the measurement of peak height of the maximum spectral feature of the sample compared to that of a known reference spectrum. The second used a computer-assisted method which correlates all the spectral information from the trace gas sample with that of a high signal-to-noise reference spectrum of the gas. Using the spectral correlation program, which improves the detection limit by a factor of ~ 2, a specified gas can be detected even though its spectral peak heights are less than the noise. A complete description of the spectral correlation method along with the computer program listing is presented. The detection limits for

CO, N_2O, and CO_2 using the computer program are 2.0, 1.0, and 0.3 ppM, respectively (10 cm gas cell, 35 minute measurement time and 640 Torr). By measuring the volume of gas intercepted by the sample beam, these detection limits correspond to 7.6, 5.2, and 1.9 ng for CO, N_2O, and CO_2 respectively.

52025 Analysis of resin-bead loaded U and PU samples with a single-stage mass spectrometer. Smith, D.H. (Oak Ridge National Lab., TN); Walker, R.L.; Bertram, L.K.; Carter, J.A.; Goleb, J.A. *Anal. Lett.;* **12**: No. 7, 831-840(1979).

The resin bead sample loading technique has been applied to a conventional single-stage mass spectrometer equipped with pulse counting. Isotopic data obtained for U and Pu are comparable to those obtainable from similar instruments using conventional techniques. 1 figure, 2 tables.

SEPARATION PROCEDURES

52026 Determination of the ratio of contact to solvent-separated ion pairs in $ZnSO_4$ in methanol via high-field conductometric measurements. Hemmes, P. (Rutgers Univ., Newark, NJ); McGarvey, J.J. *Inorg. Chem.;* **18**: No. 7, 1812-1813(Jul 1979).

High-field conductometric measurements of the ratio of contact to solvent-separated ion pairs have been made on the system $ZnSO_4$ in methanol ($K = 5.8 \times 10^4$). The method used has quite general applicability for such determination and is one of the few such generally useful methods. The method is based on the dynamic response of the system to a short high-field pulse. Under most conditions the ion-pair interconversion cannot take place during the pulse and then the electrolyte behaves as if it contained only a free ion outer-sphere complex equilibrium. 1 table.

52027 Use of 24-crown-8's in the solvent extraction of $CsNO_3$ and $Sr(NO_3)_2$. Gerow, I.H.; Davis, M.W. Jr. (Univ. of South Carolina, Columbia). *Sep. Sci. Technol.;* **14**: No. 5, 395-414(1979).

The feasibility of a solvent extraction process for removing strontium and cesium from acidic high activity nuclear waste is shown. Both strontium and cesium can be extracted from an aqueous HNO_3 phase containing the metal nitrates into an organic phase containing kerosene or CCl_4 as a diluent and complexing agents dissolved in the diluent. The most promising results obtained thus far have required the use of a mixture of three metal complexing agents: tributyl phosphate, di-2-ethylhexyl phosphoric acid, and 4,4'(5')-di-tert-butylbenzo-24-crown-8. The highest distribution coefficients obtained (organic/aqueous) were 1.45 +- 0.05 for Cs^+ and 200 for Sr^{2+}. The extraction is reversible and is strongly dependent on the pH of the aqueous phase. The metal can be removed from the organic phase by lowering the pH to 1, while raising the pH above 3 causes the metal to return to the organic phase. The utility of this extraction technique for nuclear processing will depend on the radiation stability of the complexing agents and the degree of selectivity obtained when extracting strontium and cesium from mixed fission products. 12 figures, 4 tables.

INORGANIC AND PHYSICAL CHEMISTRY

CHEMICAL AND PHYSICOCHEMICAL PROPERTIES

REFER ALSO TO CITATION(S) 52014, 52023, 52048, 52051, 52275, 52276

52028 Generation of N_3 in the thermal decomposition of NaN_3. Piper, L.G.; Krech, R.H.; Taylor, R.L. (Physical Sciences Inc., Woburn, Massachusetts 01801). *J. Chem. Phys.;* **71**: No. 5, 2099-2104(1 Sep 1979).

Gaseous azide radicals at concentrations up to 10^{13} molecules cm^{-3} appear to have been generated in a flow system in the thermal decomposition of solid NaN_3 at temperatures between 150 and 350 °C. Between 150 and 250 °C the activation energy for the decomposition is 0.80 +- 0.15 eV. The addition of small concentrations of oxygen atoms to the reactor excites NO γ-band chemiluminescence from the reaction O+N_3/sup k4/→NO ($A\ ^2\Sigma^+$)+N_2. The γ-band emission may be used as a sensitive tracer for N_3 in kinetic measurements; k_4 was determined to be (10 +- 4) x 10^{-12} cm^3 $molecule^{-1}$ s^{-1}. Large concentrations of O atoms quantitatively convert the N_3 to NO, and the resulting O/NO afterglow has been used to determine absolute concentrations of the N_3 radicals. Several other chemiluminescent emissions are observed, most notably the nitrogen first-positive emission excited in azide-radical recombination.

52029 Effect of pressure on bonding in black phosphorus. Cartz, L.; Srinivasa, S.R.; Riedner, R.J.; Jorgensen, J.D.; Worlton, T.G. (Department of Mechanical Engineering, Marquette University, Milwaukee, Wisconsin 53233). *J. Chem. Phys.;* **71**: No. 4, 1718-1721(15 Aug 1979).

The bond lengths and bond angles of orthorhombic black phosphorus have been determined as a function of hydrostatic pressures to 26.6(5) kbar using time-of-flight neutron powder diffraction. We show that the markedly anisotropic compression reported previously results from a large pressure-induced shortening of the van der Waals bonds separating layers of atoms combined with a shear motion within the layers. Covalently bonded chains of atoms along the a direction remain very rigid. The average effective linear compressibility for van der Waals bonds is 1.48(9) x 10^{-3} $kbar^{-1}$ while the average effective linear compressibility for covalent bonds is an order of magnitude smaller, 2.6(8) x 10^{-4} $kbar^{-1}$.

52030 Titanium(III) chemistry: electron-transfer reactions with ground-state poly(pyridine)osmium(III) complexes, quenching reactions with excited-state poly(pyridine)ruthenium(II) complexes, and formal reduction potentials. Brunschwig, B.S.; Sutin, N. (Brookhaven National Lab., Upton, NY). *Inorg. Chem.;* **18**: No. 7, 1731-1736(Jul 1979).

Potentiometric titrations of aquotitanium(III) with ferric ions have been performed in hydrochloric acid solution. The potentiometric data are described by E (V vs. NHE) = 0.03 - 0.059 log ([Ti(III)]/[Ti(IV)][H^+]^2)at 25°C and 3.0 M ionic strength and are consistent with the interpretation that Ti^{3+}(aq) and TiO^{2+} are the principal titanium(III) and titanium(IV) species, respectively, present at acid concentrations of 0.1 - 3.0 M. Rate constants for the oxidation of titanium(III) by a series of osmium(III) complexes, OsL_3^{3+}, where L is a bipyridine or phenanthroline derivative, have been determined at 25°C and 3.0 M ionic strength. The rates are interpreted in terms of the reactions of Ti^{3+}(aq) and $TiOH^{2+}$. The rate constants are correlated with the Marcus theory, and the exchange rate constants for the $Ti^{4+\ 3+}$(aq) and $TiOH^{3+\ 2+}$ couples are estimated. The rate constants for the reaction of titanium(III) with the excited states of the ruthenium(II) complexes RuL_3^{2+} are insensitive to the reduction potentials of the ruthenium(II) complexes. Arguments are presented to show that the quenching reactions proceed predominatly by energy-transfer mechanisms. The implications of these results for the production of Ti^{2+}(aq) in quenching reactions are discussed. 6 figures, 5 tables.

52031 Structural studies of precursor and partially oxidized conducting complexes. 20. A reduction in platinum-chain dimerization in rubidium tetracyanoplatinate chloride (2:1:0.3) trihydrate, $Rb_2[Pt(CN)_4]Cl_{0.3} \cdot 3.0\ H_2O$, at 110 K as revealed by a neutron diffraction study. Brown, R.K.; Williams, J.M. (Argonne National Lab., IL). *Inorg. Chem.;* **18**: No. 7, 1922-1925(Jul 1979).

The crystal and molecular structure of the partially oxidized tetracyanoplatinate (POTCP) complex $Rb_2[Pt(CN)_4]Cl_{0.3} \cdot 3\ H_2O$ has been studied at low temperature (T = 110 K) to determine if the degree of Pt-chain dimerization observed at 298 K remains constant. Crystals of the complex are tetragonal (space group P4mm) with unit cell dimensions a = 10.104 (4) A, c = 5.743 (2) A, and V/sub c/ = 586.3 A^3 for Z = 2. A 1.74% decrease in cell volume was observed upon cooling from 298 to 110 K. For the derivation of very high-precision structural parameters, a replicate data set of 1183 reflections was collected and averaged to yield 586 independent data of which 539 had $F_o^2) > \sigma(F_o^2)$. The structure was refined by full-matrix least-squares techniques to final $R(F_o^2)$ and R/sub w/(F_o^2) values of 0.056 and 0.077, respectively. A decrease in both the average Pt—Pt spacing (~ 0.2 A to 2.87 A) and, unexpectedly, the degree of dimerization [Pt—Pt(110 K) = 2.862 (6) and 2.885 (6) A vs 2.877 (8) and 2.924 (8) A at 298 K] is observed at 110 K. However, the electrical conductivity of this complex, which might be expected to increase with decreased Pt-chain dimerization, falls off rapidly with decreasing temperature. These seemingly contradictory observations are discussed, and the temperature-dependent electrical conductivity is interpreted within the framework of a Peierls metal-insulator transition. We also present a new interpretation of the possible correlation between the degree of partial oxidation (DPO) of the platinum atoms in POTCP salts and the presence of Pt—Pt intrachain dimerization. 3 figures, 1 table.

52032 Properties and reactivities of pentadentate ethylenediaminetetraacetate complexes of ruthenium(III) and -(II). Matsubara, T.; Creutz, C. (Brookhaven National Lab., Upton, NY). *Inorg. Chem.;* **18**: No. 7, 1956-1966(Jul 1979).

The reaction of the pentadentate edta complex of ruthenium(III) with various entering ligands L has been studied as a function of pH, temperature, and L at 0.2 M ionic strength in aqueous solution. Over the pH range 0.8 to 8.5, the species Ru/sup III/(edta)H_2O^- is the sole form reactive in the substitution processes. Both forward (k_1) and reverse (k/sub -1/) rate constants Ru(edta)H_2O^- + L in equilibrium (k_1,k/sub -1/) Ru(edta)L^- + H_2O have been determined, as well as activation parameters for the complexation (k_1) process (L, k_1 in $M^{-1}s^{-1}$ (25°C), k/sub -1/ in s^{-1} (25°C), ΔH_1^+ in kcal mol^{-1}, ΔS_1^+ in cal deg^{-1} mol^{-1}): acetonitrile, 30 +- 7, 3.2 +- 0.2, 8.3 +- 0.5, -24 +- 4; thiocyanate, 270 +- 20, 0.5 +- 0.1, 8.9 +- 0.5, -18 +- 3; pyridine, 6300 +- 500, 0.061 +- 0.002; isonicotinamide, 8300 +- 600, 0.7 +- 0.2, 6.6 +- 0.5, -19 +- 3; pyrazine, 20,000 +- 1000, 2.0 +- 0.5, 5.7 +- 0.5, -20 +- 3. Forward rate constants for the analogous substitution reaction for Ru/sup II/(edta) H_2O^{2-} (25°C, 0.2 M ionic strength) are as follows: thiocyan-

ate, 2.7 +- 0.2 $M^{-1}s^{-1}$; acetonitrile, 13 +- 1 $M^{-1}s^{-1}$; isonicotinamide, 30 +- 15 $M^{-1}s^{-1}$. The substitution reactions of Ru/sup III/(edta)H_2O^- proceed by an associative mechanism, while those of Ru/sup II/(edta)H_2O^{2-} appear to be dissociative in nature. Spectra and reduction potentials for the Ru(edta)L/sup -/2-/ complexes are reported. 4 figures, 11 tables.

52033 Oxidation of azide and azidopentaamminechromium(III) by peroxymonosulfate in aqueous solution. Thompson, R.C. (Univ. of Missouri, Columbia); Wieland, P.; Appelman, E.H. *Inorg. Chem.;* **18**: No. 7, 1974-1977(Jul 1979).

The oxidation of azide by peroxymonosulfate has been studied in acid, neutral, and basic solutions, and the oxidation of $Cr(NH_3)_5N_3^{2+}$ by peroxymonosulfate has been studied in acid. The reaction with azide obeys the rate law $k_1[N_3^-][HSO_5^-]$ in acid and neutral solution and the rate law $k_2[N_3^-][SO_5^{2-}]$ in base. The reaction with $Cr(NH_3)_5N_3^{2+}$ obeys the rate law $k_3[Cr(NH_3)_5N_3^{2+}][HSO_5^-]$. At 25°C, k_1 = 0.66 L/(mol s), k_2 = 0.0076 L/(mol s), and k_3 = 0.013 L/(mol s). Oxygen-18 tracer experiments show that the reactions proceed by transfer of a terminal peroxide oxygen of the peroxymonosulfate to the reductant. 4 tables.

52034 Study of iron oxide surface by adsorption and temperature-programmed desorption. Kung, M.C.; Cheng, W.H.; Kung, H.H. (Northwestern Univ., Evanston, IL). *J. Phys. Chem.;* **83**: No. 13, 1737-1744(28 Jun 1979).

Catalytic sites on an iron oxide surface, active in the selective oxidation of butene to butadiene, were studied by adsorption and temperature-programmed desorption of cis-2-butene, butadiene, and carbon dioxide. Three distinct types of sites were identified: isomerization site, selective oxidation site, and combustion site. Results indicate that the three sites are independent of each other. Interaction of hydrocarbons was the weakest with the isomerization site, and strongest with the combustion site. Desorption from the oxidation sites can be identified. By quantitatively determining the desorption products in the adsorption of cis-2-butene and butadiene, concentrations of th selective oxidation and the combustion sites were estimated. 8 figures, 4 tables.

52035 Rational synthesis of unidimensional mixed valence solids. Structure oxidation state-charge transport relationships in iodinated nickel and pailadium bisbenzoquinonedioximates. Brown, L.D. (Northwestern Univ., Evanston, IL); Kalina, D.W.; McClure, M.S.; Schultz, S.; Ruby, S.L.; Ibers, J.A.; Kannewurf, C.R.; Marks, T.J. *J. Am. Chem. Soc.;* **101**: No. 11, 2937-2947(23 May 1979).

A detailed study is presented of crystal structure, stoichiometry, oxidation state, and electron transport in the materials $Ni(bqd)_2$, $Pd(bqd)_2$, $Ni(bqd)_2I_{0\ 019}$, $Ni(bqd)_2I_{0\ 5}$. S, and $Pd(bqd)_2I_{0\ 5}$. S, where bqd = o-benzoquinonedioximato and S = an aromatic solvent. The compound $Pd(bqd)_2I_{0\ 50}$. 0.52o-$C_6H_4Cl_2$ was shown by single-crystal x-ray diffraction to crystallize in the tetragonal space group D/sub 4h/^{2}-P4/mcc, with four formula units in a cell of dimensions a = 16.048 (7) and c = 6.367 (3) A. The crystal structure consists of stacked $Pd(bqd)_2$ units, each staggered by 65° with respect to its nearest neighbors, and disordered chains of iodine atoms extending in the c direction. The Pd—Pd distance is 3.184 (3) A, Pd—N = 1.996 (7) A, and the $Pd(bqd)_2$ units are rigorously planar. The predominant form of the iodine present is I_3^- (ν/sub fundamental/ 107 cm^{-1}). Crystallization of $Ni(bqd)_2$ from benzene containing traces of iodine produces the new orthorhombic phase $Ni(bqd)_2I_{0\ 019}$. It crystallizes in the space group D/sub 2h/^{26}-Ibam with four formula units in a unit cell of dimensions a = 16.438 (2), b = 14.759 (4), and c = 6.360 (2) A. Full-matrix least-squares refinement gave a final value of the conventional R index (on F) of 0.11 for 1026 reflections having $F_o^2 > 3\ \sigma(F_o^2)$. The structure contains rigorously planar $Ni(bqd)_2$ units stacked along the c axis with each molecule staggered by 68° with respect to its nearest neighbors. The Ni—Ni distance is 3.180 (2) A and Ni—N = 1.88 (10) A. Single-crystal electrical conductivity measurements (dc and 100-Hz ac) in the stacking direction show an increase in conductivity upon partial oxidation of $>10^3$ (Ni) and $>10^4$ (Pd). Maximum conductivities at 300 K are $Ni(bqd)_2I_{0\ 52}$. 0.32 $C_6H_5CH_3$ = 1.1 x 10^{-5} $(\Omega\ cm)^{-1}$ and $Pd(bqd)_2I_{0\ 5}$. 0.52 o-$C_6H_4Cl_2$ = 8.1 x 10^{-3} $(\Omega\ cm)^{-1}$. 46 references, 9 figures, 10 tables.

52036 Study of the bonding in transition metal carbonyl hydrides. Chen, H.W.; Jolly, W.L.; Kopf, J.; Lee, T.H. (Univ. of California, Berkeley). Contract W-7405-ENG-48. *J. Am. Chem. Soc.;* **101**: No. 10, 2607-2610(9 May 1979).

The metal 2p/sub 3/2/, carbon ls, and oxygen ls binding energies of the gaseous molecules $Co_2(CO)_8$, $HCo(CO)_4$, $Fe(CO)_5$, $H_2Fe(CO)_4$, $Mn_2(CO)_{10}$, and $HMn(CO)_5$ have been measured by x-ray photoelectron spectroscopy. From qualitative considerations of the binding energy shifts on going from the transition-metal carbonyls to the corresponding carbonyl hydrides, it is concluded that the hydrogen atoms in the carbonyl hydrides are negatively charged. By application of the potential model, approximate hydrogen atom charges of -0.3, -0.8, and -0.75 are calculated for $H_2Fe(CO)_4$, $HMn(CO)_5$, and $HCo(CO)_4$, respectively. 2 tables.

52037 Ferric ion sequestering agents. 1. Hexadentate O-bonding N,N',N''-tris(2,3-dihydroxybenzoyl) derivatives of 1,5,9-triazacyclotridecane and 1,3,5-triaminomethylbenzene. Weitl, F.L.; Raymond, K.N. (Univ. of California, Berkeley). *J. Am. Chem. Soc.;* **101**: No. 10, 2728-2731(9 May 1979).

Two new types of sequestering agents for ferric ion have been prepared. Both are tris(2,3-dihydroxybenzoyl) (DHB) derivatives of triamines and are patterned after the microbial iron chelating agent enterobactin. Compound 10, 1,5,9-N,N',N''-tris(2,3-dihydroxybenzoyl)cyclotriazatridecane, was prepared from spermidine (5) and 2,3-dioxomethylenebenzoyl chloride. It consists of a flexible cyclic ring with three appended DHB groups. The second ligand type is based on the planar mesitylene group; 1,3,5-N,N',N''-tris(2,3-dihydroxybenzoyl)triaminomethylbenzene (15) was prepared from trimesoyl chloride (11) and 2,3-dimethoxybenzoyl chloride (1). The model mono-DHB ligand, N,N=dimethyl-2,3-dihydroxybenzamide (3), was prepared from dimethylamine and the previously unreported 2,3-dioxosulfinylbenzoyl chloride (4). Compound 4 was not a useful synthon is the preparation of 10 or 15. Preliminary pH-titration and optical spectroscopic data indicate that compound 15 (= H_6L) complexes Fe^{3+} more effectively than either 10 or 3 to give a tris(catecholate) complex, FeL^{3-}, which is fully formed at pH 8 and which removes Fe^{3+} from its human transferrin complex as effectively as does enterobactin. 3 figures.

52038 Apparent concurrent acetylene—vinylidenecarbene rearrangements, silyl—acetylide metathesis, and alkyne cleavage in the interaction of bis(trimethylsilyl)acetylene with (eta^5-C_5H_5)$Co(CO)_2$. Crystal and molecular structure of a novel biscarbyne complex: [$\mu_3$eta^1-CSi$(CH_3)_3$][$\mu_3$eta^1-$C_3Si(CH_3)_3$][eta^5-C_5H_5)$Co]_3$. Fritch, J.R. (Lawrence Berkeley Lab., CA); Vollhardt, K.P.C.; Thompson, M.R.; Day, V.W. Contract W-7405-ENG-48. *J. Am. Chem. Soc.;* **101**: No. 10, 2768-2770(9 May 1979).

Neat bis(trimethyl)silylacetylene has been used as a co-oligomerization partner with (C_5H_5)$Co(CO)_2$ to form an array of molecular structures. This communication primarily reports the results of a crystal study of the trinuclear transition metal cluster. Monocrystals obtained from hexane are orthorhombic, space group P/sub bcn/-D/sub 2h (No. 60) with a = 11.333 (2) A, b = 18.205 (4) A, c = 25.679 (4) A, and Z = 8. Three dimensional diffraction data were collected on an automatic diffractometer. The structural patterns have been refined to convergence, R = 0.044 for 2407 independent reflections. The crystals are composed of discrete electron precise cluster molecules. The electronic configuration of the cobalt atoms is explained. Bond lengths and bond angles are included. The mechanism of the formation of the compound is discussed. The compound appears to be extremely stable. 1 figure.

52039 Molybdenum site of sulfite oxidase. Structural information from x-ray absorption spectroscopy. Cramer, S.P. (California Inst. of Tech., Pasadena); Gray, H.B.; Rajagopalan, K.V. *J. Am. Chem. Soc.;* **101**: No. 10, 2772-2774(9 May 1979).

The results indicate both oxo and sulfur coordination for the molybdenum in this enzyme. By correlating the Mo K-absorption edge changes with a variety of model compounds, and by curve fitting the x-ray absorption fine structure data with previously determined phase shift and amplitude functions, a detailed structural model for the sulfite oxidase molybdenum site may be proposed. It was conducted that the Mo in sulfite oxidase is bound to a mixture of oxo- and sulfur-donor ligands. 2 figures, 1 table.

52040 Molybdenum site of xanthine oxidase. Structural evidence from x-ray absorption spectroscopy. Tullius, T.D.; Kurtz, D.M. Jr.; Conradson, S.D.; Hodgson, K.O. (Stanford Univ., CA). *J. Am. Chem. Soc.;* **101**: No. 10, 2776-2779(9 May 1979).

Xanthine oxidase was isolated from unpasteurized buttermilk by a standard procedure. Extended x-ray absorption fine structure (EXAFS) data indicate that reduced xanthine oxidase contains molybdenum in the four valence oxidation state. Curve fitting of the EXAFS data for oxidized xanthine oxidase suggests that there are two different Mo-ligand distances, 1.5 oxygen atoms at 1.71 A and 2 sulfur atoms at 2.54 A. Including a third sulfur atom at a longer distance significantly improved the fit. Several possible formulations are proposed. 2 figures, 1 table.

52041 Remote sensing of sulphur dioxide. Hamilton, P.M. (Central Electricity Research Lab., Leatherhead, England); Varey, R.H.; Millan, M.M. *Atmos. Environ.;* **12**: No. 1-3, 127-133(1978).

A discussion showed that only correlation spectrometry and differential lidar are sensitive enough to measure trace amounts of SO_2. The correlation spectrometer measures line integrals of concentration, or burdens, by analyzing incident uv radiation for absorption by SO_2. It has been widely used to measure vertical burdens against a skylight background and emission rates from traverses of a plume near its source, which are limited by the accuracy of the associated wind speed rather than by the spectrometer. Comprehensive measurements of horizontal dispersion and its dependence on times of travel and sampling have also been obtained from traverses farther downwind. The differential lidar provides range-resolved measure-

ments of concentration by reflecting pulses of laser light at two wavelengths with different absorption coefficients from particles along the line of sight. It offers a sensitivity of a few ppB to ranges over 1 km with resolution in space and time of 1000 m and 10 sec. The instrument has already been demonstrated in prototype form and is now being developed for operational use. Table, graphs, and 39 references are included.

ISOTOPE EXCHANGE AND ISOTOPE SEPARATION

52042 Multiple-photon excitation of difluoroamino sulfur pentafluoride: A study of absorption and dissociation. Lyman, J.L.; Danen, W.C.; Nilsson, A.C.; Nowak, A.V. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *J. Chem. Phys.;* **71**: No. 3, 1206-1210(1 Aug 1979).

Multiple-photon absorption and dissociation experiments with difluoroamino sulfur pentafluoride (SF_5NF_2) along with results of previous experiments with SF_6 and S_2F_{10} have led us to conclude that while the density of vibrational states of a polyatomic molecule influences the absorption process, the specific structure of an absorbing species is probably a more important factor. Absorption of intense infrared radiation by SF_5NF_2 occurs with virtually no decrease in the absorption cross section, up to a fluence of 0.03 J/cm^2. This fluence level is sufficient for isotopically selective cleavage of the weakest molecular bond (S—N). The reaction probability increases with about the third power of the laser energy fluence. The infrared absorption spectrum of SF_5NF_2 has three strong absorption bands between 850 and 1000 cm^{-1}. Reaction probability is much greater for irradiation at frequencies within the center band than within the high frequency band.

ORGANIC CHEMISTRY

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CHEMICAL AND PHYSICOCHEMICAL PROPERTIES

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52043 Absolute rate parameters for the reactions of formaldehyde with O atoms and H atoms over the temperature range 250—500 K. Klemm, R.B. (Department of Energy and Environment, Brookhaven National Laboratory, Upton, New York 11973). *J. Chem. Phys.;* **71**: No. 5, 1987-1993(1 Sep 1979).

Absolute rate coefficients for the reaction of H atoms and O atoms with formaldehyde were determined over the temperature range of 250 to 500 K. Linear Arrhenius behavior was observed in log(k/sub i/) vs 1/T plots for both reactions and the following rate parameters were obtained: $k_1(T) = (3.27 \pm 1.61) \times 10^{-11} \exp(-3670 \pm 365/RT)$ cm^3 molec^{-1} s^{-1}, $k_2(T) = (2.78 \pm 0.32) \times 10^{-11} \exp(-3030 \pm 80/RT)$ cm^3 molec^{-1} s^{-1}. Indicated error limits are two standard deviations. These results are compared with those of previous studies and are further discussed in terms of extrapolation to higher temperatures.

52044 Vibrationally stimulated addition reactions between hydrogen halides and unsaturated hydrocarbons: A negative result. Herman, I.P.; Marling, J.B. (University of California, Lawrence Livermore Laboratory, Livermore, California 94550). *J. Chem. Phys.;* **71**: No. 2, 643-650(15 Jul 1979).

No evidence for enhancement of gas phase addition reactions between hydrogen halides and unsaturated hydrocarbons was observed in cases where one reactant was prepared in a high vibrational state by laser excitation of an overtone transition. The specific reaction systems studied were HCl(ν=5 or 6)+ various unsaturated hydrocarbons, and also C_2H_2(00500)+HBr or HCl, at room temperature. The reactant states were prepared by one photon-overtone absorption inside a cw dye laser, to an energy level above the activation energy of the corresponding thermal reaction. It is estimated that the rate constant for addition of these vibrationally excited molecules is at least 10—1000 times slower than the rate corresponding to the pre-exponential factor of the associated thermal reaction, depending on the employed rate of collisional quenching. Also, the reaction of C_2H_2(00500)+HBr did not appear to accelerate even when heated to 300° C.

52045 Molecular and crystal structure of bis(μ-acetato)-bis(norbornadiene)dirhodium(I): a catalyst for the isomerization of quadricyclane to norbornadiene. Reis, A.H. Jr.; Willi, C.; Siegel, S.; Tani, B. (Argonne National Lab., IL). *Inorg. Chem.;* **18**: No. 7, 1859-1863(Jul 1979).

Bis(μ-acetato)-bis(norbornadiene)dirhodium(I) has been structurally characterized. The compound has been shown to be an active catalyst for the isomerization of quadricyclane to norbornadiene. This material crystallizes in the centrosymmetric monoclinic space group $P2_1/c$ with unit cell constants (T = 20°C) a = 9.7733 (10) A, b = 15.2859 (15) A, c = 12.1815 (14) A, and β = 103.563 (8)°. All 3151 unique reflections were used in the x-ray structure analysis which refined to an R/sub F/ of 0.028. The Rh(1)—Rh(2) distance is 3.1050 (7) A. Each Rh atom is bonded to two oletin moieties of a norbornadiene ligand and to two oxygen atoms of the bridging acetate ligands. Each Rh coordination sphere has two approximate square-planar configuration with average Rh—oletin and Rh—O distances of 1.975 (4) and 2.106 (7) A, respectively. The Rh atoms lie 0.098 and 0.157 A out of their respective coordination planes. The dihedral angle formed between these planes is 50.1°, while the angle between the planes defined only by the Rh and acetate oxygens is 40.2°. Hydrogen atoms on the norbornadiene groups are within van der Waals contact distances, indicative of strong steric interactions between the ligands of the dimer. 4 figures, 8 tables.

52046 Valence isomerization of quadricyclane catalyzed by bis(μ-acetato)-bis(norbornadiene)dirhodium: evidence for a rhodocyclobutane intermediate. Chen, M.J.; Feder, H.M. (Argonne National Lab., IL). *Inorg. Chem.;* **18**: No. 7, 1864-1869(Jul 1979).

Quadricyclane isomerization is catalyzed by red-orange [Rh(NBD)(AcO)]$_2$ to give norbornadiene (75%) and two endo bis(norbornadienes), 1 (23%) and 2 (2%), at 25°C. The reaction is characterized by the formation and disappearance of yellow Rh(III) intermediates. In CH_2Cl_2 at 25°C the rate law $-d[Q]/dt = (0.64\ s^{-1})[Cat]_0$ adequately describes the results of kinetic studies carried out in the presence of large excesses of Q and NBD and with $[Cat]_0 > 10^{-4}$ M. At -50°C rhodocyclohexane intermediates in the formation of dimers were detected and characterized by ^{1}H and ^{13}C{^{1}H} NMR spectra. The results are consistent with a stepwise mechanism involving insertion of Rh(I) into a cyclopropyl ring to form a rhodocyclobutane intermediate. 4 figures, 3 tables.

52047 Graph theoretical ordering of structures as a basis for systematic searches for regularities in molecular data. Randic, M.; Wilkins, C.L. (Univ. of Nebraska, Lincoln). *J. Phys. Chem.;* **83**: No. 11, 1525-1540(31 May 1979).

Selected molecular data on alkanes have been reexamined in a search for general regularities in isomeric variations. In contrast to the prevailing approaches concerned with fitting data by searching for optimal parameterization, the present work is primarily aimed at established trends, i.e., searching for relative magnitudes and their regularities among the isomers. Such an approach is complementary to curve fitting or correlation seeking procedures. It is particularly useful when there are incomplete data which allow trends to be recognized but no quantitative correlation to be established. One proceeds by first ordering structures. One way is to consider molecular graphs and enumerate paths of different length as the basic graph invariant. It can be shown that, for several thermodynamic molecular properties, the number of paths of length two (p_2) and length three (p_3) are critical. Hence, an ordering based on p_2 and p_3 indicates possible trends and behavior for many molecular properties, some of which relate to others, some which do not. By considering a grid graph derived by attributing to each isomer coordinates (p_2,p_3) and connecting points along the coordinate axis, one obtains a simple presentation useful for isomer structural interrelations. This skeletal frame is one upon which possible trends for different molecular properties may be conveniently represented. The significance of the results and their conceptual value is discussed. 16 figures, 3 tables.

52048 Synthesis, stereostructure, pyramidal inversion, and alkylation of 1-thioniabicyclo[4.4.0]decane salts. Roush, D.M.; Price, E.M.; Templeton, L.K.; Templeton, D.H.; Heathcock, C.H. (Univ. of California, Berkeley). *J. Am. Chem. Soc.;* **101**: No. 11, 2971-2981(23 May 1979).

Eastman's sulfonium salt, 1-thioniabicyclo[4.4.0]decane tetrafluoroborate, has been prepared by an improved process and shown to be an equimolar mixture (molecular compound) of trans and cis steroisomers 1a and 1b, each of which has been isolated in pure form. The 6-methoxycarbonyl analogue 9 has also been prepared. Stereostructures have been assigned by a combination of ^{13}C NMR, 360-MHz ^{1}H NMR, and single-crystal x-ray analysis of salt 9 ($X^- = I^-$). Crystals of 9 are monoclinic, space group $P2_1/n$, a = 8.890 (3) A, b = 20.120 (7) A, c = 8.150 (3) A, β = 110.17 (4)°, Z = 4, t = 20°C, R = 0.042 for 1432 x-ray reflections with $F^2 > 2\sigma$. Activation parameters for inversion of salt 1a are found to be $\Delta H^+ = 28.0 \pm 0.9$ kcal mol^{-1} and $\Delta S^+ = -3.8 \pm 2.5$ eu in the range 90.07 to 105.80°C. Unstabilized sulfonium ylides were prepared and their interconversion by pyramidal inversion of sulfur has been investigated; activation parameters for the conversion were found to be $\Delta H^+ = 20.5$ kcal mol^{-1} and $\Delta S^+ = 6$ eu. Three of the four stereoisomeric 2-methyl-1-thioniabicyclo[4.4.0]decanes have been prepared and their sterostructures assigned by ^{13}C NMR. Evidence is adduced that both ylides react with electrophiles in a stereoselective manner. Treatment of salt 1 with tert-butyllithium at -72°C yields the corresponding ylide anions, which undergo stereoselective methylation to provide the 2,10-dimethyl-1-thioniabicyclo[4.4.0]decanes, stereostructures of which are assigned by ^{13}C NMR. The ring fusion bond

of 9 undergoes reductive cleavage, leading to an interesting synthesis of 6-methoxycarbonylthiacyclodecane.

52049 Maleylacetone cis-trans-isomerase. Mechanism of the interaction of coenzyme glutathione and substrate maleylacetone in the presence and absence of enzyme. Seltzer, S.; Lin, M. (Brookhaven National Lab., Upton, NY). *J. Am. Chem. Soc.;* **101**: No. 11, 3091-3097(23 May 1979).

Previous studies with maleylacetone cis-trans-isomerase suggest that the coenzyme, glutathione (GSH), may act as a nucleophile in the enzyme-catalyzed cis-trans isomerization. In the absence of enzyme, reaction of the coenzyme with maleylacetone or its trans isomer, fumarylacetone, has been found to lead to an adduct, S-2-(4,6-dioxoheptanoic acid)glutathione. The same diastereomer of the adduct is formed from either geometric isomer, suggesting that the reaction of GSH with maleylacetone proceeds by a slow catalyzed cis-trans isomerization followed by a rapid reaction of GSH conjugate addition to the trans isomer. This mechanism is confirmed by an isotope dilution experiment and a kinetic method involving repetitive addition of fractional equivalents of GSH to a solution of maleylacetone. The intermediate formed during GSH-catalyzed cis-trans isomerization is suggested to be the dienediol formed by sulfur attack at C-2, and this intermediate undergoes bond rotation and elimination before protonation at C-3 can take place. By analogy and additional evidence, a similar mechanism and intermediate are suggested for the enzyme-coenzyme-substrate reaction. 2 figures, 4 tables.

52050 Flash photolysis in the adsorbed state: pyrene on porous glass. Piciulo, P.L.; Sutherland, J.W. (Brookhaven National Lab., NY). Contract EY-76-C-02-0016. *J. Am. Chem. Soc.;* **101**: No. 11, 3123-3125(23 May 1979).

The kinetics of the decay of triplet pyrene adsorbed on porous glass have been studied. The samples were photolyzed at ambient temperatures using krypton lamps and a conventional flash photolysis system. A transient absorption, which was formed during the flash, was observed in the wavelength range 400 to 700 nm. This signal decayed according to first-order kinetics and the rate constant was independent of wavelength. The intensity of the absorbance, measured at 520 nm, increased linearly with flash intensity, while the rate of decay remained unchanged. The transient absorption was assigned to that of triplet pyrene formed during the excitation flash. At ambient temperature, the first-order rate constant for triplet decay was 7.95 +- 0.75 s^{-1}, corresponding to an average lifetime of 126 +- ms. Comparable lifetimes observed for pyrene in other systems are: 1.8 ms in n-hexane at 300 K, 333 ms in viscous paraffin at 300 K, 500 to 700 ms in EPA glass at 77 K, and 400 ms in plastic at 300 K. Preliminary studies have shown that the triplet lifetime was affected by temperature as well as by the surface environment, which varied according to the outgassing history of the particular sorbent sample. 2 figures, 1 table.

52051 Structural results relevant to the molybdenum sites in xanthine oxidase and sulfide oxidase. Crystal structures of MoO_2L, L = $(SCH_2CH_2)_2NCH_2CH_2X$ with X = SCH_3, $N(CH_3)_2$. Berg, J.M. (Stanford Univ., CA); Hodgson, K.O.; Cramer, S.P.; Corbin, J.L.; Elsberry, A.; Pariyadath, N.; Stiefel, E.I. *J. Am. Chem. Soc.;* **101**: No. 10, 2774-2776(9 May 1979).

Single-crystal x-ray diffraction have been completed for these two compounds: (i) X = SCH_3; and (2) X = $N(CH_3)_2$. Bond angles and bond lengths are given. The x-ray absorption fine structure (EXAFS) analysis of 1 and 2 are compared with the spectra of oxidized forms of xanthine oxidase and sulfur oxidase. Curve fitting analysis of the data, in their oxidized forms, both enzymes contain the MoO_2^{2+} unit. The average M=O distances, 1.71 A, are the same for both proteins. Sulfur atoms are present at average distances of 2.42 and 2.54 A for sulfite and xanthine oxidase, respectively. A more distant sulfur is present in both enzymes at 2.85 A. Similarities in the EXAFS spectra for 1 and sulfite oxidase Mo—O and Mo—S bond lengths are apparent. Comparisons of the Mo—S distances in the enzymes with those of 1 and 2 suggests configurational features about the molybdenum sites in the enzymes. The thiolate sulfurs in 1 and 2 are trans to each other and cis to the oxo groups with the Mo—thiolate distances all between 2.40 and 2.42 A. The distances are consistent with other known structures containing thiolates cis to Mo=O. Sulfite oxidase has similar Mo—S distances, but in xanthine oxidase a longer distance (2.54 A) is observed. Since a pronounced trans effect is known to exist for M=O bonds, this longer distance may be characteristic of a thiolate sulfur trans to a Mo—O. 2 figures, 1 table.

52052 High pressure ternary equilibrium in aqueous—hydrocarbon systems. Irani, C.A.; McHugh, D.J. (Exxon Research and Engineering Co., Linden, NJ). pp 600-608 of High-Pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Ternary equilibrium for the systems water—benzene—3-methylhexane, water—benzene—1-heptene and water—benzene—1-hexene were measured. Unsaturation in the non-aromatic fraction has been found to have a greater effect on solvent selectivity than molecular size or branching. Thus, 3-methylhexane and n-heptane show identical behavior, while 1-heptene results in lower aromatics selectivity. Addition of a fourth component like carbon dioxide shifts the water—aromatic miscibility boundary to higher temperatures and results in lower hydrocarbon solubility.

52053 High-pressure synthesis of polyacohols by catalytic hydrogenation of carbon monoxide. Fonseca, R.; Jenner, G.; Kiennemann, A.; Deluzarche, A. (Universite Louis Pasteur, Strasbourg, France). pp 733-738 of High-Pressure science and technology. Volume 1. Physical properties and material synthesis. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

A multilayered vessel comprising an external jacket of 35 NCD 16 steel and a liner of Z5 NCTD 26-15 steel was developed for carrying out the reaction up to 4 kbar and 350°C. The reaction produces mainly ethylene glycol, glycerol, and methanol; the first two are formed in appreciable amounts only if rhodium catalysts are used. The ligand effect is essential for good selectivity in polyalcohols; pyridine and its hydroxylated derivates, particularly 3-hydroxypyridine, are efficient ligands. Solvents containing C—O bonds are favorable for polyalcohol synthesis. At least 900 bar pressure is required for formation of ethylene glycol. The complex $Rh_{13}(CO)_{30}^{2-}$ is probably responsible for the synthesis of polyalcohols.

ELECTROCHEMISTRY

REFER ALSO TO CITATION(S) 52026, 52040

PHOTOCHEMISTRY

REFER ALSO TO CITATION(S) 52050

52054 (DOE/ER/04927—1) **Chlorophyll photochemistry in condensed media: triplet state quenching and electron transfer to quinone in cellulose acetate films.** Cheddar, G.; Castelli, F.; Tollin, G. (Arizona Univ., Tucson (USA)). 1979. Contract ER-78-S-02-4927. 26p. P 03/MF A01.

Chlorophyll a was incorporated into cellulose acetate films and the triplet decay and electron transfer to p-benzoquinone in aqueous solution was studied using laser flash photolysis and ESR. The triplet was found to decay by first order kinetics with the same rate constant regardless of chlorophyll concentration, but the yield was concentration dependent. This is due to quenching at the ground and/or singlet state levels. In the presence of quinone, the triplet is quenched and, when the quinone is in an aqueous solution in contact with the film, chlorophyll cation radical ($C.^+$) as well as the semiquinone anion radical ($Q.^-$) can be observed. The $C.^+$ decays by second order kinetics with a rate constant of 1.5 x 10^6 M^{-1} sec^{-1}. Although triplet conversion to radicals is slightly lower in the films as compared to homogeneous solutions (~ 3 times), the lifetimes of the radicals are greatly increased (~ 10^3 times).

52055 Photolytic decomposition of lithium aluminum hydride powder. Herley, P.J.; Spencer, D.H. (State Univ. of New York, Stoney Brook). *J. Phys. Chem.;* **83**: No. 13, 1701-1707(28 Jun 1979).

The ultraviolet photolysis of powdered $LiAlH_4$ has been investigated at room temperature by using pristine material and material subjected to ^{60}Co γ-ray irradiation. In all sampls, similar shaped pressure vs. time curves are obtained that comprise an initial deceleratory period followed by a constant rate of hydrogen gas evolution. The data curves can be resolved into one saturating-exponential component and one linear component. The final (linear) stage approximates a second-order dependence on light intensity. This dependence indicates that two excited sites are required to produce a decomposition center. For a 1.0 x 10^6 rd γ-ray dose the irradiation increases the deviation from almost second-order dependence. This is consistent with a previously developed phenomenological theory. In addition, low γ-ray doses (below 7.0 x 10^3 rd) produce a decrease in the magnitude of the exponential component, a decrease in time required to reach the final stage and the steady state rate. In the γ-ray dose range from 7.0 x 10^3 to 1.0 x 10^7 rd the effect is reversed. These results are interpreted to be produced by an increase in the concentration of radiolysis product with increasing dose. 8 figures, 3 tables.

RADIATION CHEMISTRY

52056 (COO—3221-58) **Partitioning of electrostatic and conformational contributions in the redox reactions of modified cytochromes c.** Ilan, Y.; Shafferman, A.; Feinberg, B.A.; Lau, Y.K. (Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry; Wisconsin Univ., Milwaukee (USA). Dept. of Chemistry). 1979. Contract EY-76-C-02-3221. 30p. P 03/MF A01.

The reduction of acetylated, fully succinylated and dicarboxymethyl horse cytochromes c by the radicals CH_3CHOH, CO_2^-, O_2^-, and e^-/sub aq/, and the oxidation of the reduced cytochrome c derivatives by $Fe(CN)_6^{3-}$ were studied using the pulse radiolysis technique. Many of the reactions were also examined as a function of ionic strength. By obtaining rate constants for the reactions of differently charged small molecules redox agents with the differently charged cytochrome c derivatives at both zero ionic strength and infinite ionic strength, electrostatic and conformational contributions to the electron transfer mechanism were effectively partitioned from each other in some cases. In regard to cycochrome c electron transfer mechanism, the results, especially those for which conformational influences predominate, are supportive of the electron being transferred in the heme edge region.

52057 Ratio analysis of electron spin echo modulation envelopes in disordered matrices and application to the structure of solvated electrons in 2-methyltetrahydrofuran glass. Ichikawa, T.; Kevan, L.; Bowman, M.K.; Dikanov, S.A.; Tsvetkov, Y.D. (Department of Chemistry, Wayne State University, Detroit, Michigan 48202). *J. Chem. Phys.;* **71**: No. 3, 1167-1174(1 Aug 1979).

A new analysis for two pulse and three pulse electron spin echo modulation data is presented which is independent of the echo decay function. The experimental ratios of maxima to minima of the echo modulation curve are compared with simulated ones to obtain the number of interacting nuclei, their distances, and their isotropic coupling by a least squares fit. From the best simulation, the empirical echo decay function can be determined and the original experimental data can be simulated. This new method is applied to new three pulse and old two pulse [L. Kevan et al., J. Chem. Phys. 63, 409 (1975)] electron spin echo data on solvated electrons in 2-methyltetrahydrofuran (MTHF) glass at 77 K. This analysis together with previous second moment data gives a revised model for electron solvation in this matrix based on a statistical orientation of the MTHF ring carbon planes toward the electron. In this statistical configuration model three equivalent MTHF molecules form the first solvation shell with their ring carbon atom planes perpendicular to the electron and oriented statistically. The closest protons are 3.4 A from the electron with a proton hyperfine constant of 0.4 MHz which is equivalent to a deuteron hyperfine constant of 0.06 MHz.

52058 Crystal and molecular structure of 1,5′-bidecaboran(14)yl: a new borane from γ irradiation of decaborane(14). Brown, G.M. (Oak Ridge National Lab., TN); Pinson, J.W.; Ingram, L.L. Jr. Contract W-7405-ENG-26. *Inorg. Chem.;* **18**: No. 7, 1951-1956(Jul 1979).

The previously unknown structure of the most abundant of several isomers $B_{20}H_{26}$ produced by γ irradiation of decaborane(14) has been determined by x-ray crystal-structure analysis. The molecule, named 1,5′-bidecaboran(14)yl, is made up of a 1-decaboran(14)yl group linked by a two-center B—B bond to a 5-decaboran(14)yl group. The linking B1—B′5 bond, a type for which no previous precise metrical data exist, has a length of 1.698 (3) A. The interatomic distances and angles in the decaboranyl groups, after correction for the effects of thermal motion, agree remarkably well with the corresponding ones in decaborane(14) known from analysis of low-temperature neutron-diffraction data. Most of the larger differences are for distances and angles involving atoms B1 and B′5 of the connecting link. Crystallographic data: monoclinic, space group $P2_1/n$, a = 7.235 (1) A, b = 15.453 (4) A, c = 14.895 (3) A, β = 91.42 (2)°, 4 formula units per cell, d/sub calcd/ = 0.967 g/cm^3 [λ(Cu Kα) 1.5418 A]. 2 figures, 5 tables.

52059 Reactions of diethylhydroxylamine with radiolytically produced radicals in aqueous solutions. Saunders, B.B. (Argonne National Lab., IL); Gorse, R.A. Jr. *J. Phys. Chem.;* **83**: No. 13, 1696-1700(28 Jun 1979).

The rates of reaction of OH, e/sub aq/-, and CO_3^- with N,N-diethylhydroxylamine (DEHA) in aqueous solutions have been measured. The rates obtained are k(OH + DEHA) = 1.3 x $10^9 M^{-1}s^{-1}$,k(e/sub aq/$^-$ + DEHA) = 4.8 x $10^7 M^{-1}s^{-1}$, and k(CO_3^- + DEHA) = 4.3 x $10^7 M^{-1}s^{-1}$. The nitroxide radical intermediate produced by hydrogen abstraction in the OH and O^-/DEHA systems has an absorption peak at 400 nm, and the uv and visible spectrum is presented. This nitroxide radical is not produced in the CO_3^-/DEHA system, indicating that the mode of reaction of CO_3^- with DEHA does not involve hydrogen abstraction. The nitroxide radical disappears via a bimolecular reaction with the rate constant 2k(nitroxide) = 7.6 x $10^8 M^{-1}s^{-1}$. 4 figures, 1 table.

52060 Negative activation energy for the self-reaction of HO_2 in the gas phase: dimerization of HO_2. Lil, R.R.; Gorse, R.A. Jr.; Sauer, M.C. Jr.; Gordon, S. (Argonne National Lab., IL). *J. Phys. Chem.;* **83**: No. 13, 1803-1804(28 Jun 1979).

This report deals with measurements of a rate constant over the temperature range 276 to 400°K, using a pulse-radiolysis technique which has been described by Hamilton and Lii. For the stated mechanism, the experimentally observed activation energy is seen to be an average activation energy over the temperature range studied. Negative activation energies are also observed when water vapor or ammonia are present. 1 figure.

RADIOCHEMISTRY AND NUCLEAR CHEMISTRY

HOT-ATOM CHEMISTRY

52061 (COO—2190-^{1}J) **Dynamics and mechanisms of hot chemistry stimulated by recoil methods. Progress report, March 1, 1978—February 28, 1979.** Spicer, L.D. (Utah Univ., Salt Lake City (USA)). Nov 1978. Contract EY-76-S-02-2190. 17p. P 02/MF A01.

The nuclear recoil chemical activation process in cyclobutane-t and subsequent inter- and intra-molecular energy transfer in recoil tritium and recoil chlorine hot reaction systems are analyzed. A stepladder model for intermolecular energy transfer from cyclobutane-t on collision shows average quanta of energy transferred range from 0.5 to 10 kcal/collision in He, N_2, CO_2 and cyclobutane bath gases. The recoil energy spectrum of hot chlorine atoms generated via the $^{37}Cl(n,\gamma)^{38}Cl$ reaction is also reported. The average recoil energy is found to be 294 eV and the maximum is 528 eV. Average reaction energy is calculated to be relatively independent of composition over the range from 0 to 99% moderation with noble gases in well scavenged systems of moderate reactivity. Geometrical isomerization accompanying the gas phase chlorine atom replacement reaction in 2,3 dichlorohexafluoro-2-butene as a function of moderation has been further investigated. A thermal or near thermal reaction path having a trans/cis product ratio of 1.3 and a high energy process which preferentially forms trans product from both cis and trans reactant are found. Dynamical features associated with the observed high energy inverse isotope effect in the reaction of chlorine atoms with H_2 and D_2 have been investigated through a non-Boltzmann rate constant analysis. The origin of this kinetic isotope effect is attributed to the secondary reactive process of collisional dissociation of translationally, vibrationally, and rotationally excited hydrogen chloride product molecules. Investigation of the kinetics and mechanisms of photochemical reactions between sulfur dioxide and aliphatic hydrocarbons has been initiated.

52062 (SAN—0034-T1) **Nuclear methods in chemical kinetics. Technical progress report, April 1, 1978—March 31, 1979.** (California Univ., Davis (USA). Crocker Nuclear Lab.). 1979. Contract EY-76-S-03-0034-217. 25p. P 02/MF A01.

The 1978—1979 DOE research proposal included the following projects: (i) gas phase thermal F-to-HF reactions; (ii) gas phase thermal ^{18}F olefinic addition reactions; (iii) steady state hot atom kinetic theory; (iv) moderator effects on nuclear recoil ^{18}F substitution reactions; and (v) new experimental methodology. As detailed below, significant progress has been achieved in all of these areas. In addition, new work has been initiated upon the development of a realistic potential form of kinetic collision theory.

PROPERTIES OF RADIOACTIVE MATERIALS

52063 (BNL—25810) **Evaluation of radiolabeled ruthenium compounds as tumor-localizing agents.** Srivastava, S.C.; Richards, P.; Meinken, G.E.; Som, P.; Atkins, H.L.; Larson, S.M.; Grunbaum, Z.; Rasey, J.S.; Clarke, M.H.; Dowling, M. (Brookhaven National Lab., Upton, NY (USA); Veterans Administration Hospital, Seattle, WA (USA); Boston Coll., Chestnut Hill, MA (USA)). 1979. Contract EY-76-C-02-0016. 22p. (CONF-790321—9). P 02/MF A01.

From 2. international symposium on radiopharmaceuticals; Seattle, WA, USA (18 Mar 1979).

This work introduces a new class of radiopharmaceuticals based on ruthenium-97. The excellent physical properties of Ru-97, the high chemical reactivity of Ru, the potential antitumor activity of several Ru coordination compounds, and BLIP production of Ru-97, provide a unique combination for the application of this isotope in nuclear oncology. A systematic study was undertaken on the synthesis, characterization, and evaluation of a number of ruthenium-labeled compounds. In a variety of animal tumor models, several compounds show considerable promise as tumor-localizing agents when compared to gallium-67 citrate. The compounds studied (with Ru in different oxidation states) include ionic Ru, a number of hydrophilic and lipophilic chelates, and various ammine derivatives.

52064 Hydrido[tris(hexamethyldisilyamido)]thorium(IV) and -uranium(IV). Turner, H.W.; Simpson, S.J.; Andersen, R.A. (Univ. of

California, Berkeley). *J. Am. Chem. Soc.;* **101**: No. 10, 2782(9 May 1979).

The first monomeric monohydride derivatives of the 4f- and 5f-block metals are described; $HTh[N(SiMe_3)_2]_3$ and $HU[N(SiMe_3)_2]_3$. Reaction of chloro[tris(hexamethyldisilylamido)] thorium (IV) with i molar equiv of sodium hexamethyldisilylamide in refluxing tetrahydrofuran yields thorium hydride in pentane. The deuteride can be prepared by refluxing the starting compounds in perdeuteriotetrahydrofuran. The uranium hydride and deuteride can be prepared similarly. The reaction products were characterized by mp, ir and NMR spectra, although the hydride signal was not located in the ^{1}HNMR spectrum of the uranium hydride. The metal bound hydrides were further characterized by their reaction chemistry.

RADIOISOTOPE PRODUCTION

REFER ALSO TO CITATION(S) 52063

COMBUSTION, PYROLYSIS, AND HIGH-TEMPERATURE CHEMISTRY

52065 (COO—4433-2) **Theoretical studies on heterogeneous combustion. Progress report, March 1, 1978—February 28, 1979.** Law, C.K. (Northwestern Univ., Evanston, IL (USA). Dept. of Mechanical Engineering and Astronautical Sciences). 1979. Contract EG-77-S-02-4433. 106p. P 06/MF A01.

In liquid-fueled chemical power plants, the fuel is usually introduced into the combustor in the form of a spray jet. This program aims to study the various heterogeneous processes involved during: (1) vaporization, ignition, deflagration, and extinction of single fuel droplets, and (2) the vaporization and ignition of the spray as a whole. During this period, the numerical modeling of unsteady droplet combustion in a reactive environment simulating the spray interior was completed. One basic feature of the classical droplet combustion theory, in which the instantaneous rate of fuel vaporization from the droplet is equal to the rate of fuel consumption at the flame, is questioned; a theory is formulated which shows that a significant portion of the fuel vaporized is actually used in filling up the space between the droplet and the flame instead of being consumed at the flame. The effect of possible condensation of ambient moisture on the spray vaporization rate was investigated. (DLC)

52066 **Theoretical prediction of self-propagating, diffusion- and decomposition-limited intermetallic reactions.** Margolis, S.B.; Green, R.M. (Sandia Lab, Livermore, Calif). *Combust. Flame;* **34**: No. 3, 245-252(Apr 1979).

A method for predicting the steady-state structure and propagation velocity of an infinite, exothermic alloying process is presented. It is assumed that two unreacted solid-phase metals, one of which is assumed to be in a combined state with a gaseous species, are premixed in stoichiometric proportions. it is also assumed that the propagation of the reaction is limited not only by thermal and mass diffusion, but also by the need for the gaseous species to be completely driven off before the two metals can react. The governing ordinary differential system possesses an equilibrium point in the burned region at infinity, and an asymptotic analysis in this region shows the structure of the equilibrium point to be that of a saddle point. 8 refs.

ENGINEERING

GENERAL ENGINEERING

REFER ALSO TO CITATION(S) 52415

FACILITIES AND EQUIPMENT

52067 (COO—2733-21) **Experiment and prediction in the bending of a nickel beam at 200°C.** Mautz, J.A.; Hart, E.W. (Cornell Univ., Ithaca, NY (USA). Dept. of Theoretical and Applied Mechanics). May 1979. Contract EY-76-S-02-2733. 29p. P 03/MF A01.

The results of an experiment on the bending response of a Nickel prismatic beam under four point loading at 200°C are described. The specimens have been subjected to histories of steady applied moment with a sequence of step changes both positive and negative. The measured results are compared with predictions based on Hart's constitutive equations. The experimental conditions and procedures are described. The experiment and the predictions are compared with prior studies.

52068 (LA—7904-MS) **Calibration of a rapid quench vessel.** Charles, R.W.; Vidale, R.J. (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG-36. 24p. P 02/MF A01.

A rapid quench vessel of new design has been calibrated at elevated temperature and pressure with a water pressure medium. Calibrations were done over 6.8 cm of the bottom of the vessel at angles of inclination (hot end, measured from the horizontal) of -10°, -5°, -2.5°, 0°, 2.5°, 5°, and 10° at temperatures of 300, 450, 600, and 750°C and 2 kbar = P/sub tot/. Results show a water pressure medium is satisfactory at all temperatures if the angle of inclination is +5° or +10°. A similar set of measurements were performed on a standard rod vessel. These results show the rod vessel to be essentially inclination independent.

52069 **Acceleration of flat plates by multiple staging.** Fowles, G.R.; Leung, C.; Rabie, R. (Washington State Univ., Pullman); Shaner, J. pp 911-919 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Pressure attainable in conventional shock wave equation of state experiments are limited by the velocities to which flat plates can be accelerated. The paper describes the results of theoretical and experimental work to date in an investigation of the potential use of staging methods to increase the impact velocities available from light gas guns. Experiments have been performed on the 4-in. gas gun at Washington State University (WSU) at lower velocities and on the Lawrence Livermore Laboratory (LLL) two-stage gun at higher velocities. Some simplified analytical calculations in the linear approximation are described to illustrate the concept, and the results of 1-D computer calculations are presented together with a procedure for optimizing the design. Finally, the results of initial experiments are presented.

CRYOGENIC AND SUPERCONDUCTING EQUIPMENT AND DEVICES

REFER ALSO TO CITATION(S) 51983, 52367, 52371

52070 **Reciprocating magnetic refrigerator for 2—4 K operation: Initial results.** Barclay, J.A.; Moze, O.; Paterson, L. (Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *J. Appl. Phys.;* **50**: No. 9, 5870-5877(Sep 1979).

The basic theory and design of a reciprocating magnetic refrigerator to pump heat from 2.2 to 4.2 K is presented. The results of initial experiments are shown. These results include conduction losses, eddy current losses, frictional losses, and mixing losses. Two cooling cycles were attempted and a net cooling power of 52 mW was observed at 1/60 Hz. The key problems in this design are identified and discussed.

SHIPPING CONTAINERS

52071 (NUREG/CR—0930(Pt.2)) **Puncture of shielded radioactive material shipping containers. Part II. Static and dynamic tests of laminated plates.** Larder, R.A.; Arthur, D.F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Dec 1978. Contract W-7405-ENG-48. 50p. (UCRL—52638(Pt.2)). Dep. NTIS, PC E02/MF E02.

This is a report on the development of improved analytical methods for predicting puncture of radioactive material shipping containers. 59 static and dynamic puncture tests were conducted of lead-backed, uranium-backed, and unbacked flat, circular, stainless steel plates with several mild-steel punch configurations. It was found that analytical puncture prediction requires two essential elements: (1) a code that will accurately tract stress and displacement throughout the event and (2) a criterion for identifying when and if puncture occurs. (The puncture event is not self-evident from the calculations.) The NIKE2D finite element code was coupled with the puncture criteria -- a shear stress criterion for the lead-backed plates and a maximum effective plastic strain criterion for the uranium-backed plates; the results agreed very well with the test data.

TRANSPORT AND STORAGE FACILITIES

REFER ALSO TO CITATION(S) 51116, 51117

MINING AND DRILLING EQUIPMENT AND FACILITIES

52072 **High-pressure water jet applications in drilling operations.** Labus, T.J. (Scire Corp., Downers Grove, IL). pp 356-363 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

Jet assisted or pure jet drilling can increase the drilling rate of conventional drilling methods and for pure jet drilling eliminate some of the problems associated with drilling in special formations. Jet augmented rotary drills have already shown to be both cost effective and to increase drilling rates. Pure jet drilling requires further investigation, especially in the areas of rock-jet interaction and support equipment development before its economic feasibility can be established. 11 figures.

LASERS

REFER ALSO TO CITATION(S) 52286, 52384

52073 (AD-A—060379) **Cyclotron maser instability for general magnetic harmonic number.** Uhm, H.; Davidson, R.C.; Chu, K.R. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). 1978. Contract N00014-75-C-0309. 40p. Y A03/MF A01.

This paper examines the cyclotron maser instability for general magnetic harmonic number transverse electric (TE) and transverse magnetic (TM) waveguide modes in a conducting cylinder of radius R sub c. The analysis is carried out for a hollow electron beam (radius R sub 0) propagating parallel to a uniform axial magnetic field. One of the most important features of the analysis is that the instability growth rate for magnetic harmonic numbers s=2, 3, ... is comparable to the growth rate of the fundamental (s=1) mode, particularly for moderate electron energy. Moreover, it is shown that the instability growth rate can be maximized by appropriate choice of the geometric parameter R sub 0/R sub c.

52074 (AD-A—060465) **An approximate technique for the integrations of the equations of motion in a free electron laser (FEL). One dimensional Monte Carlo analysis of a free electron laser (FEL) in a storage ring. Final report May—June 1977.** Madey, J.M.J.; Deacon, D.A.G.; Elias, L.R.; Smith, T.I. (Stanford Univ., CA (USA). High-Energy Physics Lab.). Sep 1978. Contract DASG60-77-C-0083. 36p. Y A03/MF A01.

The final report for this contract consists of two articles submitted for publication in the open literature. In the first article the authors describe an approximation they have used to compute gain, saturation, and electron statistics for a free electron laser. In the second article they report the results of a Monte Carlo method one-dimensional analysis of the equilibrium energy spread, bunch length, and average energy radiated by electrons in a storage ring free electron laser.

52075 (AD-A—060761) **Research in laser processes. Semiannual report, 1 February—31 July 1978.** Phelps, A.V.; Gallagher, A.C. (Joint Inst. for Lab. Astrophysics, Boulder, CO (USA)). 22 Sep 1978. Contract N00014-76-C-0123. 17p. Y A02/MF A01.

The modeling of electrical discharges in high pressure Na-Xe mixtures for high power laser applications has been extended to include stimulated emission by incident radiation at the wavelength of the excimer band. In addition, we have explored the effects of the use of very high sodium densities and of changes in the products of dissociative recombination. It is concluded that an efficient laser amplifier would result if one could find an excimer mixture with favorable products of dissociative recombination. The experimental evaluation of metal vapor-rare gas mixtures has been extended to include Mg-Xe mixtures. Stable discharges are obtained similar to those in Na-Xe mixtures. An apparent excimer band extends far to the red side of the resonance line of Mg at 285 nm. The large extent of this red wing suggests that it will be relatively easy to obtain gain using the Mg-Xe mixture. It remains to be seen whether the gain will be large enough to be useful and as to whether there are interfering absorption bands.

52076 (AD-A—060841) **A purely chemical HBr laser.** Arnold, S.J.; Foster, K.D. (Defence Research Establishment Valcartier, Courcelette, Quebec (Canada)). Sep 1978. 19p. Y A02/MF A01.

Purely chemical laser action in HBr has been achieved for the first time. Chlorine atoms produced by the reaction of NO with ClO_2 were reacted with molecular bromine to form bromine atoms which in turn reacted with HI to form vibrationally excited HBr. Multiline HBr laser output of 0.58 W originated from the P(1 to 0)(4), P(1 to 0)(5) and P(1 to 0)(6) lines of the v=1 to 0 vibrational band.

52077 (COO—2723-3) **Exploratory study of metal vapor lasers operating in the ultra-violet at kilowatt power levels. Final report, June 1, 1975—March 31, 1979.** Collins, G.J. (Colorado State Univ., Fort Collins (USA)). Mar 1979. Contract EY-76-S-02-2723. 10p. P 02/MF A01.

Cw laser action has been extended down to 220 nm. Moreover, cw oscillation has been obtained on twenty additional transitions in the spectral range between 220 and 320 nm. Ultra-violet laser thresholds as low as 2 A have been observed. In comparison, rare gas ion lasers require 20 to 50 A to reach threshold. Metals of interest are sputtered into the discharge giving metal densities of 10^{14} atoms cm^{-3} without using external ovens or discharge heating. Recent attempts to scale the output power levels to 1 W cw are presented with particular emphasis on the 780 nm transitions of Cu II and the 840 nm transitions of Ag II.

52078 **Studies of an 80-J KrF oscillator at excitation rates of 2—7 MW/cm³.** Tisone, G.C.; Patterson, E.L.; Rice, J.K. (Sandia Laboratories, Albuquerque, New Mexico 87185). *Appl. Phys. Lett.;* **35**: No. 6, 437-439(15 Sep 1979).

We have examined the performance of a 2-liter KrF oscillator pumped by a high-intensity electron beam. For input pump rates of 7 MW/cm^3, up to 80 J of laser energy is extracted from the cavity in 50 ns with an efficiency (laser energy divided by deposited electron-beam energy) of 11%. Values of the small-signal-gain length product g_0L, the absorption length product αL, and the saturation intensity I/sub s/ were determined to be 6—16, 0.3—0.6, and 1—10 MW/cm^2, respectively.

52079 (NTIS/PS—78/1319) **Carbon monoxide lasers (citations from the NTIS data base). Report for 1964—December 1978.** Smith, M.F. (National Technical Information Service, Springfield, VA (USA)). Dec 1978. 217p. Y N01/MF N01.

These abstracts of Federally-funded research reports cover gas discharge, gas dynamics, electron beam, and infrared and chemical lasers involving carbon monoxide as a lasing medium. Molecular excitation, energy transfer, and reaction kinetics are discussed. Studies on laser pumping are included. (This updated bibliography contains 210 abstracts, 21 of which are new entries to the previous edition.)

52080 (NTIS/PS—78/1320) **Carbon monoxide lasers. Volume 1. 1970-December 1977 (citations from the Engineering Index data base). Report for 1970—December 1977.** Smith, M.F. (National Technical Information Service, Springfield, VA (USA)). Dec 1978. 199p. Y N01/MF N01.

Worldwide research on carbon monoxide laser excitation, plasmas, development, equipment, optics, transitions, and gas mixtures are cited. Studies on optical pumping, laser spectroscopy, gas dynamics, chemical reactions, and performance tests are included. (This updated bibliograaphy contains 193 abstracts, none of which are new entries to the previous edition.)

52081 (NTIS/PS—78/1321) **Carbon monoxide lasers. Volume 2. January—December 1978 (citations from the Engineering Index data base). Report for January—December 1978.** Smith, M.F. (National Technical Information Service, Springfield, VA (USA)). Dec 1978. 133p. Y N01/MF N01.

Worldwide research on carbon monoxide laser excitation, plasmas, development, molecular reactions, equipment, optics, transitions, and gas mixtures are cited. Studies on optical pumping, gas dynamics, chemical reactions, kinetics, and performance are covered. (This updated bibliography contains 127 abstracts, all of which are new entries to the previous edition.)

52082 **Porous ceramic tubing for flowing gas lasers.** Papayoanou, A. US Patent 4,091,133. 23 May 1978. Filed date 3 Dec 1975. 3p.

Porous ceramic materials are used for the walls of tubing for flowing gas lasers. Analysis of the gas flow shows that the axial pressure variation in the porous wall tubes is more gradual than for dense wall tubes leading to more uniform gain conditions. The saturation intensity is more uniform not only due to the reduced pressure anisotropy but also, at higher flow rates, because of axially varying particle dwell times in the discharge region.

52083 **Subnanosecond relaxation oscillations in nitrogen laser pumped dye-lasers.** Racz, B.; Bor, Z.; Szabo, G.; Zoltan, C. (Attila Jozsef Univ., Szeged, Hungary). *Acta Phys. Chem.;* **23**: No. 4, 367-374(1977).

A four-level kinetic dye-laser model was investigated using N_2 laser pumping. The damped oscillation of dye-lasers and the generation of subnanosecond pulses are investigated theoretically and experimentally. The numerical solutions of coupled rate equations are in good qualitative agreement with experimental data.

HEAT TRANSFER AND FLUID FLOW

52084 (SAND—79-8022) **Experimental study of heat transfer from a yawed cylinder to air with a constant wall heat flux.** Pura, C.A. (Sandia Labs., Albuquerque, NM (USA)). Aug 1979. Contract EY-76-C-04-0789. 152p. P E04/MF E04.

The heat transfer from a yawed cylinder to air for constant wall heat flux boundary condition has been studied experimentally. Yaws of 0°, 20°, 40°, and 60° were used with a Reynolds number based on a freestream velocity of 1.1 x 10^5. This research included the design of the apparatus, numerical determination of heat conduction within the cylinder, comparison of normal (0°) results with previously published results, and obtaining data for the yaws mentioned above. The desired thermal boundary condition was obtained

with electrical heating of a very thin coating of conductive silver paint which was applied to a thin plastic cylinder. The variation in electrical resistance of this coating was found to range from + 2-1/2 to + 4-1/2%. Numerical modeling revealed that interior heat conduction effects in this design are significant only near the region of separation. The results for the yawed tests support the independence principle in the boundary layer for all yaws used. The position of the point of minimum heat transfer at 60° yaw was observed to shift slightly toward the rear relative to other yaws.

MATERIALS TESTING

REFER ALSO TO CITATION(S) 51428, 51517, 51559, 51562, 51563, 51908

52085 (SAND—79-0679) **Laboratory evaluation of two x-ray baggage inspection systems.** Schellenbaum, R.L. (Sandia Labs., Albuquerque, NM (USA)). Jun 1979. Contract EY-76-C-04-0789. 47p. P 03/MF A01.

The AS and E Micro-Dose X-ray Baggage Inspection System was designed for high-volume, detailed examination of packages at ultralow x-ray exposure levels. This system is used in airline terminals for the detection of weapons, bombs, and other contraband. It is also employed by security personnel in other facilities to search packages for contraband carried in and out of secured areas. The Micro-Dose system has a unique design concept which includes an Automatic Threat Alert System (ATA) and a zoom display presentation feature.

52086 **Materials problems and opportunities in coal-conversion systems.** Stringer, J. (Electric Power Research Inst., Palo Alto, CA). pp 527-539 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

In many of the advanced coal conversion systems now being developed, the materials of construction will be exposed to very severe conditions. It is probable that the ability of materials to withstand these conditions will ultimately determine the success or failure of the new technologies. A number of specific examples will be discussed, and four systems will be analyzed in more detail: heat exchangers in fluidized bed combustors, gas turbines in combined cycle systems, low-pressure steam turbines, and superheaters in pulverized coal boilers. In each of these cases the problem is in part the deterioration of materials in contact with the environment, but the solution to the problem requires the close integration of materials development and design engineering.

ELECTRONIC CIRCUITS AND DEVICES

REFER ALSO TO CITATION(S) 51194, 52106

52087 **High temperature electronic gain device.** McCormick, J.B.; Depp, S.W.; Hamilton, D.J.; Kerwin, W.J. (to Dept. of Energy). US Patent 4,138,622. 6 Feb 1979. Filed date 4 Aug 1977. 4p.

PAT-APPL-821,870.

An integrated thermionic device suitable for use in high temperature, high radiation environments is described. Cathode and control electrodes are deposited on a first substrate facing an anode on a second substrate. The substrates are sealed to a refractory wall and evacuated to form an integrated triode vacuum tube.

COMBUSTION SYSTEMS

REFER ALSO TO CITATION(S) 50996, 52065

52088 (ANL/EES-TM—57) **Pulse combustion technology for heating applications. Quarterly progress report, April 1—June 30, 1979.** Ahrens, F.W.; Clinch, J.M.; Tam, S.W. (Argonne National Lab., IL (USA)). Aug 1979. Contract W-31-109-ENG-38. 23p. P 02/MF A01.

The primary purpose of this program is to develop design data and procedures for pulse combustion burners. The program will thus contribute to the accelerated industrial development of cost-effective, high-efficiency systems for a variety of heating applications. The major program tasks are designated as: burner performance studies, burner noise studies, and evaluation and application. Progress in these areas is reported.

52089 (DOE/ET/1237—01/15) **Multicell fluidized bed boiler design construction and test program. Quarterly progress status report, January—March 1979.** (Pope, Evans and Robbins, Inc., New York (USA)). Jul 1979. Contract EX-76-C-C-01-1237. 80p. P 05/MF A01.

The objective of this program is to design, construct, and test a multicell fluidized-bed boiler as a pollution-free method of burning high-sulfur or highly corrosive coals without excessive maintenance problems. The fluidized-bed boiler will provide approximately 300,000 pounds of steam per hour. Steam pressure and temperature conditions were selected to meet requirements of the site at which the boiler was installed.

UNDERGROUND ENGINEERING

REFER ALSO TO CITATION(S) 51873

MARINE ENGINEERING

REFER ALSO TO CITATION(S) 52246

POLLUTION CONTROL EQUIPMENT

52090 (PB—288307) **University of Washington electrostatic scrubber tests at a steel plant. Phase report, June 1976—June 1978.** Pilat, M.J.; Raemhild, G.A.; Prem, A. (Washington Univ., Seattle (USA). Dept. of Civil Engineering). Sep 1978. 60p. Y A04/MF A01.

The report gives results of a demonstration of the effectiveness of a 1700 cu m/hr (1000 acfm) University of Washington (UW) Electrostatic Spray Scrubber in controlling fine particle emissions from an electric-arc steel furnace. The two-stage portable pilot plant operates by combining oppositely charged aerosol particles and water droplets in two water spray towers. Aerosol charging sections (coronas) with negative polarity precede each spray tower. Simultaneous inlet and outlet source tests utilizing UW Cascade Impactors--Mark V for the inlet and Mark III for the outlet--provided both size-dependent and overall mass basis particle collection efficiency information. Measured overall particle collection efficiencies ranged from 58.8 to 99.5%, depending on the electrostatic scrubber operating conditions and on the inlet particle size distribution. Tabular and graphic data is presented illustrating the effects of the corona specific plate area, liquid to gas flow rate ratio, magnitudes of particle and droplet charging voltages, and electrostatic polarities on the overall particle collection efficiencies and on the particle collection efficiency as a function of particle size.

POWER CYCLES

OTHER

52091 (UCRL-Trans—1572) **Comments on the derivation of the Carnot efficiency according to Max Planck: Thermodynamics (eleventh edition) De Gruyter 1964; and R. Clausius: Mechanical heat theory (third edition) Vieweg 1887.** Kirchhoff, J. May 1979. Translated from an unpublished German paper, 1979. 24p. P 02/MF A01.

PARTICLE ACCELERATORS

DESIGN, DEVELOPMENT, AND OPERATION

52092 **Fantasies of future Fermilab facilities.** Wilson, R.R. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510). *Rev. Mod. Phys.;* 51: No. 2, 259-274(Apr 1979).

The author presents a perspective on possible future projects at Fermilab.

AUXILIARIES AND COMPONENTS

52093 (SAND—79-0678) **Controlling magnetic field profiles.** Freeman, J.R. (Sandia Labs., Albuquerque, NM (USA)). Apr 1979. Contract EY-76-C-04-0789. 23p. P 02/MF A01.

A method for designing solenoid magnets with controlled field profiles is discussed. The method, originated by D.B. Montgomery, minimizes both the field errors and the power consumption. An NOS time-sharing computer program for the CDC-6600, entitled MAGCOR, was constructed to provide an interactive magnet design capability. Results obtained during the design of magnets for a radial line electron accelerator are presented. 9 figures.

INSTRUMENTATION

RADIATION INSTRUMENTATION

52094 Synchroton-Cerenkov detectors for electrons. Rynne, T.M. (Department of Physics, Illinois Institute of Technology, Chicago, Illinois 60616). *J. Appl. Phys.;* **50**: No. 9, 5572-5578(Sep 1979).

In the presence of an ambient medium and an external magnetic field, ultrarelativistic charged particles emit synchrotron-Cerenkov radiation. For cases in which the classical synchroton frequency greatly exceeds any characteristic absorption frequency of the medium, i.e., when the medium can effectively be treated as a free-electron gas, the photon production rates depend sensitively on the ratio of the synchroton frequency to the relativistically boosted electron plasma frequency. In principle this connection can be exploited for the construction of high-energy electron detectors (E> or $\simeq$2 GeV). These counters allow for the simultaneous determination of the electron energy, and a mass discrimination between electrons and higher-mass singly charged particles. The relative merits of synchrotron-Cerenkov detectors and some standard counters are briefly discussed.

GENERAL DETECTORS AND MONITORS

REFER ALSO TO CITATION(S) 51646, 52108

52095 (LBL—9241) **Time resolution performance studies of high speed photon detectors.** Leskovar, B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1979. Contract W-7405-ENG-48. 10p. (CONF-790720—1). P 02/MF A01.

From 4. international congress LASER 79 opto-electronics; Munich, F.R. Germany (2 Jul 1979).

The time resolution capabilities of prototype microchannel plate and static crossed-field high gain photon detectors have been investigated. The devices studied included the LEP HR350 and PM 137-proximity focused high gain microchannel plate and VPM-154A/1.6L static crossed-field photomultipliers. Measurements were made of electron transit time, rise time, time resonse, single photoelectron time spread and multiphotoelectron time spread. The experimental data have been compared with results obtained with conventionally designed RCA 8850 and C31024 high speed photomultipliers. Descriptions are given of the measuring techniques.

RADIATION DOSEMETERS

52096 Miniaturized radiation chirper. Umbarger, C.J.; Wolf, M.A. (to Dept. of Energy). US Patent Application 934,764. 17 Aug 1978. 9p.

The disclosure relates to a miniaturized radiation chirper for use with a small battery supplying on the order of 5 volts. A poor quality CdTe crystal which is not necessarily suitable for high resolution gamma ray spectroscopy is incorporated with appropriate electronics so that the chirper emits an audible noise at a rate that is proportional to radiation exposure level. The chirper is intended to serve as a personnel radiation warning device that utilizes new and novel electronics with a novel detector, a CdTe crystal. The resultant device is much smaller and has much longer battery life than existing chirpers.

NUCLEAR SPECTROSCOPIC INSTRUMENTATION

52097 (EGG—1183-1679) **Development of an airborne gamma radiation system for snow surveys.** Fritzsche, A.E. (EG and G, Inc., Las Vegas, NV (USA)). 1979. Contract EY-76-C-08-1183. 10p. (CONF-790495—1). P 02/MF A01.

From Workshop on remote sensing of snow and soil moisture by nuclear techniques; Voss, Norway (23 Apr 1979).

An airborne gamma-snow survey system requires detailed design to obtain maximum precision and accuracy. The use of NaI(Tl) gamma detectors with a full gamma energy spectrum pulse height analyzer together with a small computer provides a self-contained and flexible system. The dual detector method determines atmospheric radon perturbations in the detection system. Detailed calibration experiments must be performed to determine twenty parameters that describe the physical nature of the system. Multiple high altitude and lake flights are used to obtain background components. Simulation pads, loaded with varying concentrations of ^{40}K, ^{232}Th, and ^{238}U yield photopeak stripping coefficients and basic system sensitivity. Multiple altitude flights over land lines provide air attenuation coefficients which may be converted to water attenuation coefficients.

52098 (UCID—18224) **Evaluation of commercial wavelength dispersive x-ray spectrometers.** Ryon, R.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1979. Contract W-7405-ENG-48. 39p. P 03/MF A01.

X-ray spectrometers from the four manufacturers who market in the United States were evaluated in regard to performance, features, instrument design parameters, software, and cost. The evaluation was quantitative where possible; qualitative assessments were also made. The top ranked machine is produced by Rigaku, and is recommended for purchase. Siemens also manufactures a fine machine, which is ranked a close second.

HIGH ENERGY PHYSICS INSTRUMENTATION

52099 (LBL—9316) **Performance of a pressurized multiwire proportional chamber for neutron radiography.** Director, B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1979. Contract W-7405-ENG-48. 43p. P 03/MF A01.

Thesis.

A study was made of the effect of gas density on resolution and efficiency of a neutron sensitive multiwire proportional chamber. Increasing the density will shorten the reaction products range. A pressure vessel was designed and constructed for 4 atm thereby reducing the range of the reaction products from the neutron converter by a factor of 4, compared to 1 atm. Pressurizing the chamber to 4 atm resulted in a spatial resolution of 1mm under the most favorable operating conditions. For the type of neutron converters used improving the efficiency is limited to a choice of material. Two different materials were tried, gadolinium and boron, with efficiencies of 6.3 and 2.3%, respectively.

RADIOMETRIC INSTRUMENTS

REFER ALSO TO CITATION(S) 51558, 51688

52100 (CONF-790692—1) **X-ray and gamma ray transmission densitometry.** Lassahn, G.D.; Stephens, A.G.; Taylor, D.J.; Wood, D.B. (Idaho National Engineering Lab., Idaho Falls (USA)). 1979. Contract EY-76-C-07-1570. 149p. P 07/MF A01.

From International colloquium on densitometry; Idaho Falls, ID, USA (10 Jun 1979).

Gamma and x-ray attenuation densitometers are systems in which measurements of the attenuation of one or several radiation beams are used to infer the density of the attenuating material. This report contains discussions of theoretical and practical aspects of densitometer design, operation, and data interpretation.

52101 (NUREG/CP—0006, pp I.9.1-I.9.28) **Two-phase flow measurement by pulsed neutron activation techniques.** Kehler, P. May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

The Pulsed Neutron Activation (PNA) technique for measuring the mass flow velocity and the average density of two-phase mixtures is described. PNA equipment can be easily installed at different loops, and PNA techniques are non-intrusive and independent of flow regimes. These features of the PNA technique make it suitable for in-situ measurement of two-phase flows, and for calibration of more conventional two-phase flow measurement devices. Analytic relations governing the various PNA methods are derived. The equipment and procedures used in the first air—water flow measurement by PNA techniques are discussed, and recommendations are made for improvement of future tests. In the present test, the mass flow velocity was determined with an accuracy of 2%, and average densities were measured down to 0.08 g/cm^3 with an accuracy of 0.04 g/cm^3. Both the accuracy of the mass flow velocity measurement and the lower limit of the density measurement are functions of the injected activity and of the total number of counts. By using a stronger neutron source and a larger number of detectors, the measurable density can be decreased by a factor of 12 to .007 g/cm^3 for 12.5 cm pipes, and to even lower ranges for larger pipes.

52102 (NUREG/CP—0006, pp I.12.1-I.12.27) **Two-phase flow instrumentation research at RPI.** Lahey, R.T. Jr. May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

Instrumentation being developed for the investigation of two-phase flow phenomena of interest to nuclear technology is discussed. The instrumentation includes optical probes, electrical (impedance) probes, ultrasonic probes, and radiometric gauges.

52103 (NUREG/CP—0006, pp I.18.1-I.18.11) **Local density measurments by stationary external sources & detectors.** Kondic, N.N. (Nuclear Regulatory Commission, Washington, DC). May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

The use of radiometric gauges for local density measurements in two-phase flow mixtures is discussed. A new method is described

which is an improvement for measuring the density field across the major portion of any duct cross section.

RADIATION EFFECTS ON INSTRUMENT COMPONENTS, INSTRUMENTS, OR ELECTRONIC SYSTEMS

52104 (AD-A—060874) **Development of high level electrical stress failure threshold and prediction model for small scale junction integrated circuits. Final report.** O'Donnell, H.B.; Tasca, D.M. (General Electric Co., Philadelphia, PA (USA). Space Div.). Sep 1978. Contract DAAG39-76-C-0138. 193p. Y A09/MF A01.

This report summarizes the experimental and theoretical work performed in order to develop engineering type prediction techniques to predict both surge impedances and failure levels of small scale junction integrated circuits when exposed to EMP type environments. A further requirement was that these predictive techniques should not require a 'hands on' device evaluation but should relate the surge impedance and failure levels to some associated device parameter which could easily be obtained from a manufacturer's data sheet or other published information. The data required to develop the models was obtained by a literature search of numerous DOD and NASA agencies and contractors. In addition, 252 integrated circuits were experimentally evaluated to determine their specific pulse response and damage characteristics. These 252 devices consisted of 11 individual part types, 7 digital part types and 4 linear part types. All pulse damage experiments were performed using unipolarity, single square wave pulses of 10 nanosecond to 1 microsecond duration. Models were generated for the power failure threshold as a function of pulse width, the current failure threshold as a function of pulse width and the impedance as a function of current.

52105 (SAND—79-0646C) **Latch-up control in CMOS integrated circuits.** Ochoa, A. Jr.; Estreich, D.B.; Dawes, W.R. Jr. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 15p. (CONF-790706—1). P 02/MF A01.

From 1979 IEEE Annual conference on nuclear and space radiation effects; Santa Cruz, CA, USA (17 Jul 1979).

The potential for latch-up, a pnpn self-sustaining low impedance state, is inherent in standard bulk CMOS structures. Under normal bias, the parasitic SCR is in its blocking state, but if subjected to a high-voltage spike or if exposed to an ionizing environment, triggering may occur. Prevention of latch-up has been achieved by lifetime control methods such as gold doping or neutron irradiation and by modifying the structure with buried layers. Smaller, next-generation CMOS designs will enhance parasitic action making the problem a concern for other than military or space applications alone. Latch-up control methods presently employed are surveyed. Their adaptability to VSLI designs is analyzed.

MISCELLANEOUS INSTRUMENTS

REFER ALSO TO CITATION(S) 50955, 50997, 51556, 51563, 51650, 51651, 51660, 51688, 51689, 51691, 51908, 51909, 52022, 52041, 52102

52106 (DP-MS—79-38) **Microcomputers for nuclear instrumentation.** Byrd, J.S. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1979. Contract EY-76-C-09-0001. 17p. (CONF-790577—1). P 02/MF A01.

From Conference and exhibits on small computers session on applications in engineering and science; Clemson, SC, USA (23 May 1979).

Small, desk-top Commodore PET computers are being used to solve nuclear instrumentation problems at the Savannah River Laboratory (SRL). The ease of operating, programing, interfacing, and maintaining the PET computer makes it a cost-effective solution to many real-time instrumentation problems that involve both data acquisition and date processing. The IEEE-488 GPIB (General Purpose Instrument Bus) is an integral part of the PET hardware. This paper reviews GPIB design concepts and discusses SRL applications that use the PET computer as a GPIB controller. 11 figures, 2 tables.

52107 (LA—7886-T) **Single particle analysis with a 360° light scattering photometer.** Bartholdi, M.F. (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 173p. P 08/MF A01.

Thesis.

Light scattering by single spherical homogeneous particles in the diameter range 1 to 20 μm and relative refractive index 1.20 is measured. Particle size of narrowly dispersed populations is determined and a multi-modal dispersion of five components is completely analyzed. A 360° light scattering photometer for analysis of single particles has been designed and developed. A fluid stream containing single particles intersects a focused laser beam at the primary focal point of an ellipsoidal reflector ring. The light scattered at angles $\theta = 2.5°$ to 177.5° at phi = 0° and 180° is reflected onto a circular array of photodiodes. The ellipsoidal reflector is situated in a chamber filled with fluid matching that of the stream to minimize refracting and reflecting interfaces. The detector array consists of 60 photodiodes each subtending 3° in scattering angle on 6° centers around 360°. 32 measurements on individual particles can be acquired at rates of 500 particles per second. The intensity and angular distribution of light scattered by spherical particles are indicative of size and relative refractive index. Calculations, using Lorenz—Mie theory, of differential scattering patterns integrated over angle corresponding to the detector geometry determined the instrument response to particle size. From this the expected resolution and experimental procedures are determined.Ultimately, the photometer will be utilized for identification and discrimination of biological cells based on the sensitivity of light scattering to size, shape, refractive index differences, internal granularity, and other internal morphology. This study has demonstrated the utility of the photometer and indicates potential for application to light scattering studies of biological cells.

52108 (LBL—9323) **Instrumentation for environmental monitoring.** McLaughlin, R.D.; Hunt, M.S.; Murphy, D.L.; Chen, C.R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1979. Contract W-7405-ENG-48. 14p. (CONF-790673—2). P 02/MF A01.

From 13. annual conference on trace substances in environmental health; Columbia, MO, USA (4 Jun 1979).

In the last few years a much greater emphasis has been placed upon understanding, controlling and monitoring the environmental effects of the advancing technologies. This has resulted in rapid advances in techniques for environmental monitoring. To aid the concerned scientist in keeping abreast of these developments, the Lawrence Berkeley Laboratory publishes a collection of volumes entitled Instrumentation for Environmental Monitoring. Separated into four volumes covering four media, AIR, WATER, RADIATION, and BIOMEDICAL, they provide a source book for three types of material: (1) Monitoring Rationale. They describe the characteristics, forms, and effects of a wide variety of pollutants and the means of controlling them. Federal regulations are explained and summarized. (2) Analytical Techniques. Methods of determining specific pollutants are described with special emphasis on the principles that form the basis of instrumental methods. (3) Commercial Instrumentation. The features of most commercially available instrumentation used for the determination and monitoring of each pollutant are presented in a manner that facilitates instrumental comparisons. Examples of the types of material in the volumes and the use of the volumes are presented.

52109 (NUREG/CP—0006, pp I.1.1-I.1.33) **Progress report on LOFT ultrasonic density detector for fuel inlet blowdown measurements.** Arave, A.E.; Fickas, E.T. May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

A prototype ultrasonic density was designed for the loss-of-fluid test (LOFT) reactor core-inlet application. Separate effects and steam/water transient (blowdown) tests were conducted at the Idaho National Engineering Laboratory (INEL). The tests showed that the ultrasonic density detector is capable of performing in the rigorous LOFT type pressurized water reactor environment and of measuring the integrated density of the medium surrounding the sensor.

52110 (NUREG/CP—0006, pp I.4.1-I.4.23) **Low energy densitometer progress report.** Stephens, A.G. May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

Low photon energy densitometers are being developed for application on Semiscale and 3D Programs. For transient fluid density measurements, a single fixed detector, beryllium ring, and three different characteristic x-ray emitting sources are used. Acceptable frequency response and accuracy can be obtained with standard pulse height discrimination and rate meter electronics. Major advantages of this type system, compared to high energy units, are increased sensitivity in small and medium sized pipes, reduced radiation hazards, and no drift problems. For stationary fluid conditions, a single moving detector, beryllium ring, and single fixed low energy source are used. Data are obtained at 50 positions around a 3-in. pipe and used in a multi-flow regime model data reduction program to give local density. The large number of data points over the flow cross section permits ready regime identification and, in conjunction with the program, provides a reference against which the accuracy of few-beam densitometers can be measured.

52111 (NUREG/CP—0006, pp I.5.1-I.5.11) **Turbine performance studies at INEL.** Goodrich, L.D. Jr.; Lassahn, G.D. May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

Turbine flowmeters are an important part of the two-phase mass flow rate measurement systems used in several nuclear reactor safety research programs at the Idaho National Engineering Laboratory (INEL). Turbines are used with drag bodies or gamma densitometers to determine steam/water mass flow rates in transient flow conditions. There have been substantial discrepancies between mass flow rates calculated from data from these different instrument combinations. Part of the effort to understand and remove these discrepancies has been a continuing program of studying and evaluating models of turbine response in steam/water flow. The Kamath-Lahey model has been applied to some Loss-of-Fluid Test (LOFT) blowdown data to evaluate the importance of the transient correction. The conclusions of this evaluation are that the transient correction is significant only when the void fraction is high, and that the correction has little effect on the calculated integrated mass flow.

52112 (NUREG/CP—0006, pp I.6.1-I.6.17) **Optical probe for local void fraction and interface velocity measurements.** Abuaf, N.; Jones, O.C. Jr.; Zimmer, G.A. (Brookhaven National Lab., Upton, NY). May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

In view of the importance of obtaining unsteady local void fraction and interface velocities in liquid—vapor two-phase flows, an optical probe with a controlled tip geometry was developed and is described. In order to minimize the disturbances caused to the flow field by the presence of the probe, its dimensions have been miniaturized. The electronic and hydrodynamic response of the probe were investigated experimentally. The probe was found to be sensitive to both the interface velocities and the phase present at the probe tip. A possible explanation for the behavior of the probe is presented. Within the velocity range checked and with proper calibration, the optical probe developed can be used to determine both local void fractions and interface velocities.

52113 (NUREG/CP—0006, pp I.8.1-I.8.18) **Stereo video lens system.** Mansfield, C.R.; Spalding, J.F.; Helmick, H.H. (Los Alamos Scientific Lab., NM). May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

A stereo video lens system for two-phase flow studies is described which uses a Storz lens and a vidicon system. The triangulation algorithm used is presented and some experimental setups are illustrated.

52114 (NUREG/CP—0006, pp I.13.1-I.13.16) **Transient two-phase mass flow rate measurements with a true mass flow meter.** Class, G.; Wagner, K.; Reimann, J. (Kernforschungszentrum, Karlsruhe, Germany). May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

At present the True Mass Flow Meter (TMFM) is the only direct two-phase mass flow measuring device for both steady-state and transient flow conditions. In this paper results obtained with a TMFM developed for a small-scale blowdown loop are presented. Up to now this TMFM was used satisfactorily in more than 30 blowdown experiments. The integrated total mass flow is measured with an error of about 4%.

52115 (NUREG/CP—0006, pp I.14.1-I.14.17) **Impedance probe for detecting flow regime and measuring the phase distribution in horizontal air—water and steam—water flow.** Reimann, J.; John, H.; Mueller, S. (Kernforschungszentrum, Karlsruhe, Germany). May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

For the interpretation of the signals of two-phase mass flow measuring devices, the knowledge of flow regime or more quantitatively the knowledge of local phase distribution is of great importance. For this purpose a local measuring impedance probe was developed which is capable of measuring in steam—water flow at high pressures and other fluid systems with very small electrical conductivity. The measuring principle of this probe is shown and results from horizontal air—water flow and steam—water flow at pressures up to 10 MPa are presented. The results from the steam—water experiments show the influence of pressure on the flow regime and void fraction profiles.

52116 (NUREG/CP—0006, pp I.16.1-I.16.24) **Spatial dependence of turbine meter response in two-phase flow, MPE-547.** May 1979.

From Two-phase instrumentation review meeting; Troy, NY, USA (13 Mar 1978).

This report deals with the extension of the momentum exchange turbine model to consider explicitly the spatial distributions of phase velocities and void fraction. It provides quantitative estimates of the uncertainties introduced by such spatial distributions for both axisymmetric and asymmetric profiles. More specifically, the report includes an assessment of the uncertainties introduced in the turbine response in single-phase flow by changes in the velocity distribution from that in which the turbine was calibrated. It also examines turbine performance in annular and dispersed two-phase flow regimes. Interpretations of the turbine response with two-phase flows are given both in terms of the mass weighted fluid velocity mentioned above, as well as the volume weighted (mean) fluid velocity. The major parameters which set local fluid conditions in the annular and dispersed regimes - void fraction and velocity profiles, as well as vapor phase drift flux - are exercised to assess the resulting uncertainty in interpreting turbine meter response. The reduction in calibration factor uncertainty brought about by certain turbine design features - blade twist and increased hub diameter - are also quantified. By a somewhat more simplified analysis, the turbine meter response in stratified flow is assessed.

52117 (NUREG/CR—0769) **Radio frequency (r-f) probe for bubble size and velocity measurements.** Abuaf, N.; Feierabend, T.P.; Zimmer, G.A.; Jones, O.C. Jr. (Brookhaven National Lab., Upton, NY (USA)). Mar 1979. Contract EY-76-C-02-0016. 17p. (BNL-NUREG—50997). P 02/MF A01.

A radio frequency (r-f) probe that can provide local void fraction and interface velocity measurements in a gas-liquid two-phase flow was developed. The probe response to bubble passage was investigated with single bubble controlled experiments. For fixed geometry, the probe response was dependent on the dielectric constant of the medium surrounding the probe tip, (air or water), and on the frequency of the carrier signal supplied to the probe. Bubble lengths (< 1 cm) and average bubble approach velocities (< 160 cm/sec) were independently measured by two light sources and detectors placed at a known distance from each other and sensing the passage of each bubble. By choosing a sensitive probe tip length of 2.75 - 3 mm, the r-f probe output provided enough information to determine the bubble length and velocity. The results obtained by the two independent methods show reasonable agreement (+ - 10 percent).

52118 (SAND—79-0524J) **Bibliography: ion plating and related ion bombardment effects.** Mattox, D.M. (Sandia Labs., Albuquerque, NM (USA)). Jul 1979. Contract EY-76-C-04-0789. 26p. P 03/MF A01.

A bibliography of references concerning ion plating and related ion bombardment effects is presented. The references are listed in the year of publication.

52119 (SAND—79-0603C) **High-speed nonvolatile CMOS/MNOS RAM.** Derbenwick, G.F.; Dodson, W.D.; Sokel, R.J. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 3p. (CONF-790809—1). P 02/MF A01.

From International conference on solid state devices; Tokyo, Japan (27 Aug 1979).

A bulk silicon technology for a high-speed static CMOS/MNOS RAM has been developed. Radiation-hardened, high voltage CMOS circuits have been fabricated for the memory array driving circuits and the enhancement-mode p-channel MNOS memory transistors have been fabricated using a native tunneling oxide with a 45 nm CVD Si_3N_4 insulator deposited at 750°C. Read cycle times less than 350 ns and write cycle times of 1 μs are projected for the final 1Kx1 design. The CMOS circuits provide adequate speed for the write and read cycles and minimize the standby power dissipation. Retention times well in excess of 30 min are projected.

52120 **Single transmission line interrogated multiple channel data acquisition system.** Fasching, G.E.; Keech, T.W. Jr. (to Dept. of Energy). US Patent Application 854,444. 23 Nov 1977. 31p.

A single transmission line-interrogated multiple-channel data acquisition system is provided in which a plurality of remote station/sensor circuits each monitors a specific process variable and each transmits measurement values over a single transmission line to a master interrogating station when addressed by the master interrogating station. Typically, as many as 330 remote stations may be parallel connected to the transmission line which may exceed 7,000 feet. The interrogation rate is typically 330 stations/second. The master interrogating station samples each station according to a shared, charging transmit—receive cycle. All remote station address signals, all data signals from the remote stations/sensors, and all power for all of the remote station/sensors are transmitted via a single continuous terminated coaxial cable. A means is provided for

periodically and remotely calibrating all remote sensors for zero and span. A provision is available to disconnect any selected sensor station from the main transmission line remotely. 11 figures.

52121 New instrument for measuring surface pressure. Stenberg, M.; Loefgren, H. (Research Laboratory of Electronics, Chalmers University of Technology, Gothenburg, Sweden). *Rev. Sci. Instrum.;* **50**: No. 9, 1098-1100(Sep 1979).

A new instrument for surface pressure measurements using a floating-foil technique has been constructed. The instrument makes use of a probe in the form of a thin foil suspended at the gas/liquid or liquid/liquid interface tension. The present instrument has a dynamic range of 0.1—70 mN/m and a sensitivity better than 0.1 mN/m. Its speed of response is 50 ms but much faster measurements are possible. Measurements on behenic acid and cholesterol films on water and on a cerebroside film at a heptane/water interface are presented.

52122 Differentially pumped low-energy ion beam system for an ultrahigh-vacuum atom-probe field-ion microscope. Amano, J.; Seidman, D.N. (Department of Materials Science and Engineering and the Materials Science Center, Bard Hall, Cornell University, Ithaca, New York 14853). *Rev. Sci. Instrum.;* **50**: No. 9, 1125-1129(Sep 1979).

An ultrahigh-vacuum (UHV) differentially pumped low-energy (50—3000 eV) ion beam system for the in situ irradiation of specimens in a UHV atom-probe field-ion microscope (FIM) was designed and constructed. The ion beam system consisted of a Finkelstein-type ion source, an Einzel lens, and a magnetic mass analyzer. The ion source was connected to the analyzer chamber by small apertures which resulted in differential pumping between the ion source and the analyzer chamber; during a typical in situ irradiation of a specimen in the atom-probe FIM the total pressure was maintained at $\simeq 10^{-7}$ Torr. In the case of helium ion irradiation the optimum ion-current density was $\simeq 0.5\ \mu A\ cm^{-2}$ for 300-eV He^+ ions at the atom-probe FIM specimen. After the completion of a helium ion irradiation the pumpdown time from 5×10^{-7} to $\simeq 3 \times 10^{-10}$ Torr in the atom-probe FIM chamber was 0.5 h.

EXPLOSIONS AND EXPLOSIVES

CHEMICAL

52123 (MHSMP—79-37) **Substitute potting compounds for Sylgard 93-120. Process Development Endeavor Nos. 203 and 207.** Flowers, G.L.; Switzer, S.T. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). Jul 1979. Contract EY-76-C-04-0487. 26p. P 03/MF A01.

The report deals with the development of substitute potting compounds to replace the no longer available Dow Corning 93-120. Three different approaches to formulate a substitute, two of which were successful are presented. The efforts discussed are a part of a laarger project to better understand the silicone potting compound technology and to formulate substitutes for specific materials which have been discontinued by Dow Corning.

52124 (MHSMP—79-39) **Analysis of TATB/Phenoxy formulations by HSLC. Process Development Endeavor No. 210.** Teter, A.C. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). Aug 1979. Contract EY-76-C-04-0487. 6p. P 02/MF A01.

Analysis of the phenoxy binder in TATB/phenoxy formulations was performed by high speed liquid chromatography. The separation was made on a LiChrosorb SI-60 column (25 cm) using tetrahydrofuran as the mobile phase and uv detector for quanitation.

52125 (SAND—79-0837) **Activities of the Deflagration-to-Detonation Transition Project. Quarterly report, September—November 1978.** Lieberman, M.L. (ed.). (Sandia Labs., Albuquerque, NM (USA)). Apr 1979. Contract EY-76-C-04-0789. 46p. P 03/MF A01.

A project has been initiated to address deflagration-to-detonation (DDT) transition as it applies to low voltage detonators. Studies with the relatively new DDT explosive CP are underway in the areas of physics of DDT, compatibility, and component development. In addition, materials studies are oriented towards the development of a similar, but safer, DDT explosive. The objective of the physics studies is to establish a modeling capability; a program to achieve this end has been outlined. Preliminary experiments have shown that ignition and deflagration can be observed optically through headers. Materials studies have commenced on (a) coating CP with secondary explosives and (b) synthesizing and evaluating compounds similar to CP. Continuing compatibility work has shown an absence of evidence of corrosive attack in Mini-Dets examined under optical microscopy. Activities on two CP-loaded detonators, the MC3423 and the MC3450, are described. For the first time, CP-loaded devices have been designed which achieve a 1 amp, 1 watt, 5 minute no-fire condition, while also achieving the all-fire conditions. Test devices for each application have yielded satisfactory output. Function times of $\sim$ 10 μs have been obtained with a Velonix bridgewire pulse of 15mJ.

52126 (UCRL—52776) **Nitrate ester decomposition and degradation of molecular weight in nitrocellulose from thermal decomposition of PBX-9404 below 100°C.** Leider, H.R.; Seaton, D.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 May 1979. Contract W-7405-ENG-48. 15p. P 02/MF A01.

The thermal decomposition of nitrate ester ($-ONO_2$) in the nitrocellulose (NC) binder of PBX-9404 was studied. Evidence was found that the tri-esterified NC subunits decompose most readily; by calculating the relative populations of mono-, di-, and tri-esterfied subunits and monitoring NC composition as a function of ($-ONO_2$) loss, the extent of degradation of the NC molecular weight was estimated. Decomposition of ($-ONO_2$) obeyed second-order kinetics, and the activation energy for decomposition (26.1 kcal/mol) agreed with values calculated on the basis of weight loss or the amount of evolved gas.

52127 Effect of a physical inhomogeneity on steady-state detonation velocity. Engelke, R. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *Phys. Fluids;* **22**: No. 9, 1623-1630(Sep 1979).

A set of experiments has been performed which demonstrate that "hot spots" in an explosive control some aspects of the steady-state detonation process. It is known, from experiments, that the relationship between explosive charge size and steady-state detonation velocity (the "diameter-effect curve") is qualitatively different for homogeneous and heterogeneous explosives. The experiments to be described strongly indicate that this qualitative difference is due to localized hot regions arising from flow modifications due to the presence of physical inhomogeneities. These local hot regions apparently produce an effective chemical reaction rate which allows a stable steady-state flow at a much smaller charge size than is possible in an analogous homogeneous material. Detonation-velocity measurements were carried out on cylindrical rate sticks at a number of radii thus generating diameter-effect curves. The explosives studied were composed primarily of commercial-grade nitromethane confined in Pyrex tubes. Silica impurities, with a known particle-size distribution, were added to the nitromethane to produce a heterogeneous material. The silica impurities were held in suspension with a guar-gum gelling agent. An attempt is made to interpret the new results by use of earlier numerical and experimental results concerning initiation of detonation at hot-spots.

NUCLEAR

REFER ALSO TO CITATION(S) 52154, 52247, 52254

52128 (AD-A—060432) **Development of airblast and thermal radiation instrumentation. Final report, 16 August 1976—31 March 1978.** Kratz, H.R.; Coleman, P.L.; Wilson, R.S. (Systems, Science and Software, La Jolla, CA (USA)). 31 Mar 1978. Contract DNA001-76-C-0365. 78p. Y A05/MF A01.

This is part of a continuing effort to develop instrumentation for use in underground nuclear tests. In particular, the development of instrumentation to measure airblast and thermal radiation is described. The initial development of an instrumented sphere to measure dynamic pressure in the supersonic flow behind a blast front was completed. Experiments are described that show that it is feasible to use a bar gauge to measure pressure on a surface parallel to the axis of the bar gauge by using a piston and fluid coupling combination. Work is described on sputtering a thin (2 micron) insulating film of sapphire onto the surface of a copper disc. Such films are required in a proposed thermal radiation gauge to measure the total radiation flux in an underground nuclear explosion. Measurements of pressure in the HE driver chamber on the DABS S-2 Test are also described.

52129 (AD-A—060732) **Dynamic airblast simulator (DABS) instrumentation development. Phase I. Final report.** Baum, N. (New Mexico Univ., Albuquerque (USA). Eric H. Wang Civil Engineering Research Facility). Aug 1978. Contract F29601-76-C-0015. 198p. Y A09/MF A01.

In conjunction with the MX Program the Air Force Weapons Laboratory has been developing a Dynamic Airblast Simulator (DABS), the purpose of which is to simulate the airblast produced by a nuclear device. Since the detonation products of the explosives used to drive the DABS contribute a significant loading pulse, the environment is loaded with debris and ill-defined. Thus development of new instrumentation to parameterize this flow was undertaken. Microwave systems, an infrared detector, an optical photodiode, a debris collector, shock-on-shock instrumentation, and pressure and velocity gages were investigated. (Author)

52130 (AD-A—060798) **Collateral air blast damage. Interim report, May 1977—March 1978.** Rempel, J.R.; Wiehle, C.K. (SRI

International, Menlo Park, CA (USA)). Apr 1978. Contract DNA001-77-C-0237. 103p. Y A06/MF A01.

SRI International has been participating in a program to develop a collateral damage methodology for evaluating air blast damage to existing structures that would result from the use of tactical nuclear weapons in small towns and villages located in Western Europe. To increase the applicability of the SRI structural element computer programs for collateral damage predictions, a building subsystem program was developed. The program, BRACOB (Blast Response and Collapse of Buildings), simultaneously analyzes the response of all exterior walls on one story level of a building. The program will calculate the separate responses of exterior unreinforced masonry walls to an air blast that sweeps over the building at normal incidence. Three kinds of input are required: air blast description (e.g., peak free-field overpressure, weapon yield, and ambient conditions), floor plan information and wall structural properties (e.g., density, flexural strength, and in-plane vertical load). The program detects wall collapse and, after each collapse, changes the floor plan accordingly. Calculation continues until either the blast wave has passed through the entire building or all of the walls have collapsed. The final floor plan is output in any case.

CIVIL USES

52131 (PNE-G—89) **Project Gasbuggy: radiation contamination clearance report.** (Eberline Instrument Corp., Santa Fe, NM (USA)). 27 Jun 1979. Contract ET-78-C-08-1582. 41p. P 03/MF A01.

Project Gasbuggy was the first US underground nuclear experiment for the stimulation of low-productivity natural gas reservoirs. The report describes the radiological health and safety operations required for site cleanup and restoration to return the site to approximately its original condition. These operations were conducted from August through September of 1978. All equipment on site which was radiologically contaminated during previous gas production test activities was steam decontaminated to well below applicable release criteria and was released for unrestricted use. The radiological site restoration operations were successful. The radiological area survey indicates that no radiation levels above ambient background remain on-site. Only tritium (^3H) in quantities well below criteria remains in the on-site soil as determined by soil sampling. The quality of the natural environment was improved by the removal of numerous man-made objects, the removal and controlled disposal of the site contaminants, and the sealing from possible release to the environment of a deep underground radiological source.

52132 **Change in the permeability of a medium in the inelastic deformation zone during an underground explosion.** Rodionov, V.N.; Spivak, A.A.; Tsvetkov, V.M. (Inst. of Earth Physics, Moscow, USSR). pp 397-406 of High-pressure science and technology. Volume 2. Applications and mechanical properties. Timmerhaus, K.D.; Barber, M.S. (eds.). New York, NY; Plenum Press (1979).

From 6. AIRAPT international high-pressure conference; Boulder, CO, USA (25 Jul 1977).

The magnitude of the flow of a liquid or gas through a rock mass via a network of fractures for a given pressure drop depends on the permeability of the rock mass. This characteristic of a rock mass determines the feasibility of ore-leaching operations, coal and shale gasification, petroleum and gas extraction, etc. The experimental data presented and the analysis of these data indicate a significant change in the structure and permeability of a rock mass due to an explosion. The principal engineering problem should be seen as the elimination of the excess mass of rock from the zone of destruction in order to increase the opening of fractures. It seems that this can be accomplished by using both the multiple explosions and the peculiarities of the geological structure of the rock mass.

WEAPONRY

REFER ALSO TO CITATION(S) 52201

EXPLOSION DETECTION

52133 (AD-A—060897) **Study of selected events in the Baikal rift zone in a seismic discrimination context. Technical report.** Sobel, P.A.; Von Seggern, D.H.; Sweetser, E.I.; Rivers, D.W. (Teledyne Geotech, Alexandria, VA (USA). Seismic Data Lab.). 17 Oct 1977. Contract F08606-78-C-0007. 71p. Y A04/MF A01.

Six events from the Baikal rift zone occurring from 1971 to 1975 were examined in a seismic discrimination context. Seismograms from ALPA, LASA, NORSAR, the HGLP, the WWSSN, and the SRO stations were studied for source mechanism, Ms-mb, corner frequency, pP, complexity, and spectral ratio. All the Baikal events can be identified as earthquakes except the November 5, 1976, event which shows explosion characteristics. The characteristics of the Baikal events were compared to six East Kazakh explosions and the Aleutian explosion MILROW. No evidence is found, from the signals studied here, for a zone of high attenuation under the Baikal rift. The discriminants found to be useful in this study, with the possible exception of short-period spectral ratio which is rather unreliable, would not give correct discrimination for a suitable shot array. However there is a full magnitude range of separation in Ms:mb in this region, suggesting that a suitable shot array might be difficult to devise.

ENVIRONMENTAL SCIENCES, ATMOSPHERIC

BASIC STUDIES

52134 (LBL—9379) **Impact of energy conservation in buildings on health.** Hollowell, C.D.; Berk, J.V.; Lin, C.; Nazaroff, W.W.; Traynor, G.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1979. Contract W-7405-ENG-48. 11p. (CONF-791009—1). P 02/MF A01.

From International conference on energy use management; Los Angeles, CA, USA (22 Oct 1979).

The levels of air contaminants inside buildings are often higher than outdoor ambient levels. Interest in conserving energy has been motivating home-owners and builders to reduce infiltration and ventilation in buildings. However, the resulting decrease of indoor/outdoor air exchange may increase the concentrations of many contaminants having indoor sources. Four indoor contaminants - carbon monoxide and nitrogen dioxide from gas stoves; formaldehyde from gas stoves, particleboard, plywood, and urea-formaldehyde foam insulation; and radon from various building materials - are currently receiving considerable attention in the context of the potential health risks associated with reduced infiltration and ventilation rates. It is likely that some increased health risk will accompany an increase in indoor-contaminant exposure; hence, it is desirable not to allow these concentrations to rise above human-tolerance levels. There are several possible ways of circumventing increased health risks without compromising energy-conservation considerations. 27 references.

52135 (NOAA-TR-NWS—1007-1) **Automated prediction of boundary layer winds and turbulence for the Savannah River Laboratory. Final report.** Gilhousen, D.B. (National Oceanic and Atmospheric Administration, Washington, DC (USA)). 1979. Contract EY-77-A-09-1007. 26p. P 03/MF A01.

Objective forecasts of many weather elements produced twice daily for about 230 US cities are made by applying the Model Output Statistics (MOS) technique (Glahn and Lowry, 1972). This technique relates by a statistical method the output of numerical models interpolated to a location (predictors) to a corresponding sample of observed local weather at that location (predictand). This study describes the development and testing of MOS wind forecasts for an instrumented TV tower located near the Savannah River Laboratory (SRL). If shown to be useful, these forecasts could serve as valuable guidance in case of a nuclear incident at the installation. This study introduces several new applications of the MOS technique. In addition to forecasts of wind speed and direction, forecasts of two turbulence parameters were developed and evaluated. These turbulence parameters were the standard deviations of both the azimuth and elevation of the wind. These quantities help to estimate the amount of plume and puff spread. Forecasts of all these elements were produced for several levels on the 335 m WJBF-TV tower. Tests were conducted to see if MOS forecasts of each element were capable of resolving differences between tower levels. MOS forecasts were compared to two other types of forecasts to determine their utility. Short range persistence forecasts served as one type of comparison since SRL uses the current observed winds in their diffusion models. Climatology forecasts served as the other comparison set. (JGB)

52136 (UCRL—52680) **Regional wind-field study in complex terrain during summer sea-breeze conditions.** Porch, W.M.; Volker, P.A.; Peterson, K.R.; Weichel, R.L.; Sherman, C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Mar 1979. Contract W-7405-ENG-48. 28p. P 03/MF A01.

A regional-scale data base, consisting of wind and temperature data for June and July of 1977, was developed for the greater San Francisco Bay Area and eastward to the Central Valley. Continuous meteorological measurements were made in the area of a windy pass (Patterson Pass) 3 km east of Lawrence Livermore Laboratory. This area was chosen because of its complex terrain and importance as a downwind topographic feature affecting the dispersal of possible accidental atmospheric releases from the Laboratory and as an area of high wind-energy potential. The results of this study provided the following: (1) a data base, including over 50 stations for use in numerical wind-field regional-scale-model validation; (2) characterization of summer sea breese oscillations of ~ 6

and 12 days (this analysis is useful in calculating wind-power persistence and in understanding summer sea-breeze mechanisms in the Bay Area); and (3) successful application of an optical space-averaging wind sensor over a 1-km path across a pass to provide long-path averaged data more suitable for regional, numerical wind-field models with kilometre-size grid elements.

52137 Dynamic u-tube system for solid sorbent air-sampling method development. Severs, L.W.; Melcher, R.G.; Kocsis, M.J. (Dow Chemical Co., Denver, CO). *Am. Ind. Hyg. Assoc. J.;* **39**: No. 4, 321-326(Apr 1978).

The system consists of a U-shaped calcium chloride drying tube used as a flow chamber and sample container and having one side arm for an air inlet and another to hold the sorption tube, which contains carbon, silica gel, or another sorbent and leads to the pump. Good recoveries were obtained in tests at 85°C with silica gel as sorbent and 0.2 to 10 ppM of naphthalene, 1-methylnaphthalene, or biphenyl, and at 25°C with activated charcoal as sorbent and 0.2 to 18.0 ppM of benzene, toluene, ethylbenzene, styrene, or divinylbenzene. Thus, determinations can be made of the interaction of components, what constitutes breakthrough, what breakthrough is, and how much of a safety factor must be designed into a particular sampling program to prevent breakthrough during field sampling. The method was superior to other techniques for most applications, particularly for compounds which are normally either liquids of low volatility or solids. Diagram, graph, and tables are included.

52138 Dynamic U-tube system for solid sorbent air-sampling method development. Severs, L.W.; Melcher, R.G.; Kocsis, M.J. *Am. Ind. Hyg. Assoc. J.;* **39**: No. 4, 321-326(Apr 1978).

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CHEMICALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 52041, 52108, 52147, 52221, 52235

52139 (COO—1199-55) Precipitation chemistry trends in the northeastern United States. Stensland, G.J. (Illinois State Water Survey, Urbana (USA)). 1979. Contract EY-76-S-02-1199. 19p. (CONF-790573—2). P 02/MF A01.

From 12. University of Rochester symposium on environmental toxicity: polluted rain; Rochester, NY, USA (21 May 1979).

Historical trends of the concentrations of the various trace substances in precipitation can serve as an indication of the changes in the levels of these substances in the air. Three topics related to the precipitation chemistry data base for the United States are examined. First, since the pH of precipitation is of major interest, techniques to calculate this quantity are considered. Next, the changes in the precipitation chemistry for a central Illinois site are discussed. This site is at the western edge of present high atmospheric sulfate levels, and thus it is interesting to examine changes in the precipitation pH at this site and the reasons for them. Changes in the sulfate and nitrate at this central Illinois site and other sites further East are also discussed, and these changes are compared to the time trends in the anthropogenic source emissions. Results suggest that at present the best approach to calculating the pH of a precipitation sample is to assume that a charge balance exists and then to apply an empirical correction. With this approach the 1977 central Illinois samples are shown to be much more acid than those from 1954. The primary reason for this pH decrease is the decreased concentration of calcium and magnesium in the samples. For the mid-1970's compared to the mid-1950's the source emissions estimates for the United States were up by a factor of 1.3 for sulfur and 2.1 for nitrogen. During this same time interval the sulfate concentrations for the precipitation chemistry sites in the northeastern United States remained about the same and the nitrate concentrations increased by factors varying from 1.3 to 1.8. Since the emissions estimates increased more than the precipitation concentrations, it would seem that a smaller fraction of the pollutants were being removed over the northeast by wet processes in the mid-1970's than in the mid-1950's.

52140 Ozone pollution medical evidence hit. *Oil Gas J.;* **76**: No. 30, 21(24 Jul 1978).

EPA has proposed relaxing its standard to permit ozone levels of 0.1 ppM/hr, instead of 0.08. API contends that the 0.1 ppM/hr standard is far too stringent. According to P. J. Mullenix (Harvard Univ.), who coordinated the work of several medical experts in reviewing ozone health effects, EPA's conclusion rests on a misreading of the medical evidence. EPA claims that pulmonary function is reduced and there is possible chest discomfort and respiratory tract irritation at the 0.15 ppM level; Mullenix claims that a careful review of scientific studies reveals that none of these effects has been demonstrated at ozone exposures of 0.25 ppM for 2 to 4 hr, and the medical evidence does not support EPA's conclusion that significant adverse human health effects have been demonstrated at ozone exposures as low as 0.15 ppM for 1 hr. M. D. Hawk (Exxon Co.), in testimony on behalf of API at an EPA hearing, said that EPA did not follow the advice of its own science advisory board in setting the proposed standards and took so long to revise the standards that states can not meet the deadline of 1/1/79 in setting up their programs. J. M. Pierrard (Du Pont) told the hearing that natural sources of ozone would make it impossible to attain the proposed standard in many regions of the country. Hawk and Pierrard are chairman and vice-chairman, respectively, of API's photochemical oxidant committee.

52141 Air pollution and the atmospheric boundary layer. Randerson, D. (Natl Weather Serv, Las Vegas, Nev). *Proc. Air Pollut. Control Assoc.;* **2**: 1-21(1978).

A review of the literature on the role of boundary-layer processes in diluting and redistributing pollutants is presented and discussed. Mathematical and physical models that can account for the dynamic and thermodynamic processes of boundary-layer phenomena are presented and evaluated. Turbulence typing schemes and flow above the surface layer are dealt with. 89 refs.

52142 New developments in electro-optical monitoring of particulates. Schmitt, H.W.; Kreikebaum, G.; Shofner, F.M. (Environmental Systems Corp., Knoxville, TN). pp 67-89 of Industrial pollution control measurement and instrumentation. Cheremisinoff, P.N. (ed.). Westport, CT; TECHNOMIC Publishing Co., Inc. (1976).

From Conference on industrial pollution control measurement and instrumentation; Newark, NJ, USA (22 Mar 1976).

Two new instruments that are now available for continuous, in situ measurements of so-called fine particulates, particles having diameters $d \leq 3\mu m$ are described. These are electro-optical instruments and employ the scattering of laser or light emitting diode light at $\lambda = 0.9\mu m$. They are designed and operated so that the measurements made by them are directly in the process gas stream and have no dependence upon gas stream velocity or temperature. These instruments are additional members of the PILLS instrument family; PILLS is an acronym for Particulate Instrumentation by Laser Light Scattering. PILLS IV yields hard copy print-out of particle size distribution and concentration in the size range $0.2 < d < 3.0\mu m$. PILLS V is a mass concentration monitor yielding as its output an analog signal proportional to the total particulate mass concentration in the process gas stream; more specifically, for particle diameters in the range $0.1 < d < 10\mu m$, the output is essentially independent of the particle size distribution.

RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 52153, 52219

THERMAL EFFLUENTS MONITORING AND TRANSPORT

52143 Heat transfer through the thermal skin of a cooling pond with waves. Wesely, M.L. (Atmospheric Physics Section, Radiological and Environmental Research Division, Argonne National Laboratory, Argonne, Illinois 60439). *J. Geophys. Res.;* **84**: No. C7, 3696-3700(20 Jul 1979).

The temperature drop measured across the cool skin of a cooling pond is examined for 64 10-min data collection periods taken with wind speeds of 3—8.5 m s^{-1} (effectively at a height of 10 m) and surface temperatures of 18°—37.5°C. The total heat transfer through the skin is found with the use of bulk aerodynamic estimates of the latent and sensible heat flux densities and empirical expressions for the long-wave radiation exchange at the surface. Although it is questionable to describe the characteristics of a surface with waves by use of formulae derived partially on the assumption that a rigid boundary exists at the air-water interface, the parameterizations that result seem on the average to perform quite well. For example, values of the numerical proportionally coefficient λ [Saunders, 1967], which relates the total heat transfer to the temperature drop, increase slightly from 6 to 7 as water temperature increases; these values are near those reported previously. No variation of λ with

wind speed is detected. If λ is replaced by a numerical coefficient that also takes into account the difference of the thicknesses of the thermal and viscous sublayers, the new coefficient Λ≅λPr/sup 1/3/, where Pr is the Prandtl number, does not vary significantly with temperature of the surface skin.

SITE RESOURCE AND USE STUDIES

52144 (UCRL—50027-78) **Environmental monitoring at the Lawrence Livermore Laboratory. 1979 annual report.** Silver, W.J.; Lindeken, C.L.; Wong, K.M.; Conover, A.; White, J.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Mar 1978. Contract W-7405-ENG-48. 51p. P 04/MF A01.

In 1978, the annual average airborne gross beta activity in Livermore Valley air samples was 6.0×10^{-14} μCi/ml, or half the average observed in 1977. Airborne ^{238}U concentrations at Site 300 were higher than those at Livermore because of the use of depleted uranium (a byproduct of ^{235}U enrichment) in high-explosive tests at the Site. Soil samples collected in the off-site vicinity of the Laboratory and at Site 300 were analyzed for plutonium. Water samples collected within the Livermore Valley and at Site 300 exhibit gross beta and tritium activities within the ranges previously observed in these areas. One well-water sample from Site 3900 shows an above-average level of gross alpha activity because of naturally occurring ^{226}Ra. Tritium analyses were made on well-water samples collected near the Livermore Water Reclamation Plant (LWRP). All are well below the standards set by DOE. Tritium levels in Livermore Valley and Site 300 vegetation were also comparable to those observed in 1977. For 1978, the median annual gamma-radiation dose rate at the Laboraotry perimeter was 64 mrem, which was essentially the same as the median off-site background of 59 mrem. Operation of a 14-MeV neutron generator near the south perimeter continued to be a source of elevated radiation. However, dose rates have been reduced to about one-third of those recorded in 1977 by scheduling many high-flux experiments at a new facility (Bldg. 292). Assessment of the calculated rdiation dose to an individual from the environmental concentrations listed in this report demonstrates that the dose contribution from Laboratory operations in 1978 was small compared to the dose received locally from natural sources.

REGULATIONS

52145 **Engineering update for flue gas desulfurization technology.** Princiotta, F.T. pp 995-1001 of Energy technology V: challenges to technology. Hill, R.F. (ed.). Washington, DC; Government Institutes, Inc. (1978).

From 5. energy technology conference; Washington, DC, USA (27 Feb 1978).

The driving force for sulfur oxide control in the United States are the recently amended Clean Air Amendments, which lay out the ground rules for pollution control from power plants and other major sources for both new and existing facilities. The current New Source Performance Standard (NSPS) limits the sulfur dioxide emissions for new power plants to 1.2 lb/million Btu when solid fuels are burned. Such a restriction requires about 75% control for a 3%S coal. However, the recent Amendments direct EPA to upgrade this and other fossil-fuel standards based on best available technology for continuous emission control. It is expected that the EPA will propose an upgraded NSPS for utility boilers which will call for a specified percentage of sulfur reduction, probably between 85 to 90%. This will mandate the application of control technologies to boilers burning high- and low-sulfur coal. Since flue gas desulfurization (FGD) technology is the only commercially mature technology capable of meeting this imminent standard, much attention has recently been focused on the question of FGD reliability and economics. This paper summarized certain findings of an EPA conducted study supported by PEDCo Environmental which evaluated the status of operating FGD facilities as of late last year (1977). Also presented are some of the results of a recent review of Japanese FGD technology and timely FGD economic studies performed by the Tennessee Valley Authority under EPA sponsorship.

ENVIRONMENTAL SCIENCES, TERRESTRIAL

BASIC STUDIES

REFER ALSO TO CITATION(S) 52156

52146 (CONF-7808112—1) **Mineral cycling in tropical forests. Environmental Sciences Division publication No. 1269.** Cole, D.W.; Johnson, D.W. (Oak Ridge National Lab., TN (USA); Washington Univ., Seattle (USA)). 1978. Contract W-7405-ENG-26. 29p. P 03/MF A01.

From 5. North American forest soils conference; Ft Collins, CO, USA (6 Aug 1978).

Generalizations concerning the cycling of nutrients in the tropics are difficult because tropical forests have not been extensively studied and tropical systems are more diverse than temperate zones. Several conclusions can be made regarding nutrient dynamics in tropical forests. Selective storage of nutrients within the vegetative component of the ecosystem is not a universal means of nutrient conservation in tropical areas. There is appreciably more leaf turnover expressed as litterfall in lowland tropical forests than any other forest type. High rate of turnover is also found in the forest floor due to high temperature and humid conditions of these sites. This high rate of decomposition has an impact on the storage of carbon, affecting in turn the capacity of these systems to store nitrogen. The implication of such difference could potentially be felt in several ways. Ecologically we should expect to see plant species capable of nitrogen fixation. Management practices which exclude nitrogen fixers or cause a decrease in soil organic matter could detrimentally effect the nitrogen status and thus the productivity of these ecosystems. The rapid rate of organic turnover, both foliar and soil, also suggests that these forests have some mechanism of rapidly recapturing critical nutrients prior to leaffall. In general, the most serious effects of site clearing and burning seem to relate to N losses and erosion. Burning releases cation nutrients from vegetation and must result in some N loss. However, cations so released are retained on soil exchange sites and N losses are generally quickly compensated for by N fixation. It appears that N conservation is very tightly linked to C conservation in tropical soils. Clearing, burning, and cultivation all result in carbon losses from the soil which in turn cause a release of N. If sites are reforested, soil C contents build up and N losses from site disturbances are recovered fairly quickly by fixation.

CHEMICALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 51060, 52108, 52144, 52160, 52164, 52171, 52173, 52178, 52181

52147 (BNL—50867) **Workshop report on quantifying environmental damage from energy activities.** Moskowitz, P.D.; Rowe, M.D.; Morris, S.C.; Hamilton, L.D. (Brookhaven National Lab., Upton, NY (USA)). 11 Sep 1977. Contract EY-76-C-02-0016. 71p. P 04/MF A01.

Data and methods for quantifying environmental damage from energy activities were evaluated. Specifically, discussions were designed to identify the types and amounts of pollutants emitted by energy technologies that may affect the environment adversely, methods of estimating spatial and temporal changes in air and water quality resulting from these emissions, spatial and temporal distributions of ecosystems at risk, dose-response functions for pollutants and ecosystems at risk, and environmental and economic variables to be used to measure damage. Emphasis was on available data and on several methods for quantitative estimation of effects of energy on the environment. Damage functions that could be used to quantitate effects of ozone and sulfur oxide on agricultural crops and trees, effects of altered stream depth and velocity patterns on river fish species, and sensitivities of lake chemistry and biology to acid rainfall are listed. Also described are methods for estimating effects of carbon dioxide, sulfur dioxide, ozone, and several other atmospheric pollutants on selected terrestrial communities by using computer modeling techniques. With these techniques, quantitative estimates of the effects of energy on the environment could be developed within one to two years. Brief discussions about effects of nutrient and trace metal discharges on terrestrial ecosystems and about impacts of petroleum hydrocarbon, heat, biocides, and entrainment on aquatic ecosystems are also included.

52148 (CONF-7806143—, pp 93-105) **Movement of oils in groundwater and in rocks.** Alfoldi, L. (Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest, Hungary). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Theoretical and experimental studies on the downward seepage of hydrocarbons following an oil spill are reported. Other studies on oil pollution in nature, including theoretical deductions and mathematical solutions related to the subsurface movement of oil pollution are also discussed. (JGB)

52149 (CONF-7806143—, pp 395-403) **Disposal and the agricultural exploitation of sludges originating from geological exploration**

and from oil recovery and dehydration. Santa, M.; Zila, L.; Slezak, K.; Tarr, J. (Vyskumny Ustav Zavlahoveho Hospodarstva, Bratislava, Czechoslovakia). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

The results of two-years' field experiments in sandy soils demonstrated the fertilizing and meliorating effect of the sludges investigated, particularly when the latter were combined with donors intensifying microbial activity in the soil. As regards the crops, the low addition (25 $t.ha^{-1}$) was more efficient in the first year, but in the year following application, increased yield was obtained for the variants to which an increased sludge volume (50 $t.ha^{-1}$) had been applied. On the basis of the microbiological and biochemical analyses performed, no adverse effect on the total bacterial count of the sludge additions examined was found. The comparison of the total bacterial count with the actual respiration of the soil indicated increased intensity of microbiological degradation processes in the soil examined due to the application of sludges containing petroleum hydrocarbons. The inhibiting effect of the sludge upon ammonization and nitrification processes in the soil was determined. With regard to the tests performed, cow dung proved to be the more efficient of the two microflora donors examined. The physiological investigations conducted over a period of two years on the effects of oil sludges in light sandy soils revealed no adverse influence of the sludge on the characteristics of the plant water regime for Sudan grass, sunflowers, and sorghum. In the second year of the experiments, the presence of thick sludge in the soil was beneficial to the physiological activity of the crops investigated as well as to the chlorophyl content. When correctly applied as far as their quantity, the site, plant selection and growth acceleration and intensifying of microbial activity are concerned, the sludges can contribute to increase soil fertility.

52150 (CONF-7806143—, pp 411-417) **Interaction between oil-vegetation and soil.** Gudin, C. 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

The penetration of hydrocarbons through the superficial arable soil zone, that is approximately the first 30 cm. of soil where aerobic conditions prevail, is discussed. In particular the oxidative biodegradation of petroleum hydrocarbons is considered. An abnormal rise in the hydrocarbons concentration in the soil, due for example to the presence of a surface deposit or accidental ground pollution, is firstly expressed by immediate or deferred toxicity phenomena. This leads to a selective elimination of the least tolerant species. These toxicity phenomena are acute when there is contact between the pollutant and the aerial parts of the vegetation. They are much less so if the pollutant is introduced directly into the soil. The accumulation of hydrocarbons of their derivaties in the soil is expressed by an upset of the carbon/nitrogen balance. This leads not only to the selective toxic effect of the pollutant on the microflora, but also the microbial oxidative degradation of hydrocarbons which rapidly exhausts the available soil nitrogen. This exhaustion of nitrogen confers a selective advantage on those microbial species able to fix nitrogen, and to those plant species carrying out this fixation by symbiosis with micro-organisms. The equilibrium of the micro and macro flora is therefore disturbed. The rhizosphere of the surviving plant species gradually contributes to the depolluting activity of the microflora. It appears that the re-establishment of the carbon/nitrogen balance of the soil is achieved by two mechanisms. One tends to biodegrade the excess carbon to carbon dioxide, exhausting the inorganic nitrogen of the soil. The other tends to restore the level of nitrogen by initiating the fixation of atmospheric nitrogen. When this balance is re-established the initial micro and microflora tends to be re-established. (JGB)

RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 52144

52151 (EGG—1183-1716) **Limiting values for radionuclide concentration in the soil from remote spectrometer measurements.** Stuart, T.P. (EG and G, Inc., Las Vegas, NV (USA)). Aug 1977. 38p. P 03/MF A01.

Spectrometers that remotely sense γ-rays in the soil are usually oriented with the normal to a planar surface perpendicular to the air-soil interface. When this is the case, and when the thickness of the detector is not greater than the linear dimensions that determine the aforementioned surface area, simple assumptions can be made to calculate high and low limits for factors that convert from photopeak count rates in the spectrometer to soil concentrations. An H.P. 65 calculator program is developed to calculate these two conversion factors as a function of detector altitude, counting rates from a single measurement with a point calibration source, shielding on the surface of the detector, and depth of activity in the soil. The assumption of an exponential decrease with depth allows the previously reported results of Beck et al to be applied to convert from soil concentration to dose rate at 1 m above the ground.

52152 (ORNL/EIS—111) **Biomedical and environmental aspects of the thorium fuel cycle: a selected, annotated bibliography.** Faust, R.A.; Fore, C.S.; Cone, M.V.; Meyer, H.R.; Till, J.E. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 292p. P 13/MF A01.

This bibliography was compiled to assist in the evaluation of the health and environmental consequences of high specific activity thorium and related nuclides which could be released to the environment by activities related to the Thorium Fuel Cycle. The general scope covers studies regarding potential releases, environmental transport, metabolism, dosimetry, dose assessment, and overall risk assessment for radionuclides specific to the NASAP project. This publication of 740 abstracted references highlights the biological and medical aspects of thorium 228 and thorium 232 in man and animals. Similar studies on related nuclides such as radium 224, radium 226, radium 228, and thorium 230 are also emphasized. Additional categories relevant to these radionuclides are included as follows: chemical analysis; ecological aspects; energy; geological aspects; instrumentation; legal and political aspects; monitoring, measurement and analysis; physical aspects; production; radiation safety and control; and waste disposal and management. Environmental assessment and sources categories were used for entries which contain a multiple use of categories. Leading authors appear alphabetically within each category. Indexes are provided for : author(s), geographic location, keywords, title, and publication description. The bibliography contains literature dating from December 1925 to February 1978.

52153 (ORNL/TM—6663) **Evaluation of selected predictive models and parameters for the environmental transport and dosimetry of radionuclides.** Miller, C.W.; Dunning, D.E. Jr.; Etnier, E.L.; Hoffman, F.O.; Little, C.A.; Meyer, H.R.; Shaeffer, D.L.; Till, J.E. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 101p. P 06/MF A01.

Evaluations of selected predictive models and parameters used in the assessment of the environmental transport and dosimetry of radionuclides are summarized. Mator sections of this report include a validation of the Gaussian plume disperson model, comparison of the output of a model for the transport of ^{131}I from vegetation to milk with field data, validation of a model for the fraction of aerosols intercepted by vegetation, an evaluation of dose conversion factors for ^{232}Th, an evaluation of considering the effect of age dependency on population dose estimates, and a summary of validation results for hydrologic transport models.

SOIL

REFER ALSO TO CITATION(S) 52154

TERRESTRIAL ECOSYSTEMS AND FOOD CHAINS

REFER ALSO TO CITATION(S) 52219

52154 (AD-A—060487) **Further studies of long-term ecological effects of exposure to uranium. Final report, 1 October 1976—30 September 1977.** Hanson, W.C.; Miera, F.R. Jr. (Los Alamos Scientific Lab., NM (USA)). Jul 1978. 34p. Y A03/MF A01.

A third year of study of the ecological consequences of exposure of terrestrial ecosystems at the Los Alamos Scientific Laboratory to elevated soil concentrations of natural and depleted uranium was completed. A uranium analytical technique that uses instrumental epithermal neutron activation analysis was developed and tested. It provided more accurate and expeditious results for soil and biota samples that contain greater than 10-ng total uranium than did our other two techniques. Spatial variability in sampling for soil uranium distribution by a polar coordinate system was evaluated in randomly selected soil cores. Variations for surface (0- to 2.5-cm-deep) soils were 0.18 at 10 m from the detonation point and 0.96 at 50 m. Results were strongly influenced by past uranium dispersal patterns, variable leaching of uranium debris, and surface water runoff. A total surface (0- to 5-cm) soil uranium inventory within a 12.6-ha circle centered on the E-F detonation point was estimated to be 3000 kg when calculated by soil uranium concentration isopleths and 4500 kg when using annuli of a polar coordinate sampling system. Uranium concentrations in tissues of deer mice (Peromyscus maniculatus) and pocket gophers (Thomomys bottae) were sufficiently different to conclude that the greater bioavailability of uranium in the top few millimeters of soil at E-F Site, combined with the difference in grooming and food habits of the animals, resulted in greater contamination of deer mice than of pocket gophers. Invertebrate populations inhabiting areas of high and medium soil uranium concentrations at LASL sites were sampled by pitfall trapping and insect net sweeps.

52155 (COO—2307-16) **Biological/environmental relationships in desert ecosystems of the Nevada Test Site.** Beatley, J.C. (Cincinnati Univ., OH (USA). Dept. of Biological Sciences). Mar 1979. Contract EY-76-S-02-2307. 12p. P 02/MF A01.

Activities covered are: computer and related work (corrections and updating of card decks for Nevada Test Site data, and transfer of data and programs to tapes); publication of shrub (and tree) data for undisturbed Test Site vegetation in 1963 and 1975 (DOE/EV/2307-15); work performed in this contract period on the publications covering the vascular plants of central-southern Nevada (TID-26881); and work and publications in connection with the Endangered and Threatened species of central-southern Nevada.

SITE RESOURCE AND USE STUDIES

REFER ALSO TO CITATION(S) 51055, 51056, 51057, 51058, 51062, 51070, 51074, 52146, 52155, 52189

52156 (COO—2371-6) **Botanical inventory of the Rocky Flats AEC site. Final report, April 29, 1976—July 31, 1977.** Webber, P.J. (Colorado Univ., Boulder (USA)). Apr 1979. Contract EY-76-S-02-2371. 132p. P 07/MF A01.

The present plant life of the Rocky Flats site and surrounding area was documented. This documentation is intended as a base-line description which may be used by researchers and managers. The analysis of natural vegetation, including plant species inventory, vegetation composition study, and identification of major environmental control factors at the Rocky Flats site provides a data base on which future environmental decisions concerning, for example, future construction and handling of disturbance on this site can be made. The establishment of morphological norms for potential plant indicators of mutagenic hazards serves as a start for development of a vegetation-based system for detection of possible changes in plant life induced by accidental plutonium release around the plant. This study is not directed towards assessing any past or present industrial impacts of plutonium processing. The principal products from the contract are a list of vascular plants, bryophytes, and lichens, a 1:12,000 color vegetation map, five large scale (1:500) maps of special study and experimental areas, and a description of the morphological norms of two common vascular plant species.

52157 (ORNL/TM—6803) **White-tailed deer (Odocoileus virginianus) on the Department of Energy's Oak Ridge Reservation: data on road-killed animals, 1969—1977.** Story, J.D.; Kitchings, J.T. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 36p. P 03/MF A01.

During nine years (1969—1977), 126 white-tailed deer (Odocoileus virginianus) were killed by highway vehicles on the Department of Energy's Oak Ridge, Tennessee Reservation. Mortality was highest in the fall, and more males than females were killed among both fawns and adults. While traffic volume increased 8.2% annually, deer road-kills increased 43.8% annually. Increased road-kills were attributed primarily to an increase in the resident population.

ENVIRONMENTAL SCIENCES, AQUATIC

BASIC STUDIES

REFER ALSO TO CITATION(S) 52097, 52192

52158 (COO—4941-1) **Fatty acid ecology of plankton communities. Progress report, May 1, 1978—April 30, 1979.** Jeffries, H.P. (Rhode Island Univ., Kingston (USA). Graduate School of Oceanography). Dec 1978. Contract EP-78-S-02-4941. 22p. P 02/MF A01.

As a test of the hypothesis that fatty acid patterns of entire planktonic communities should be less variable and more predictable in offshore waters than estuarine habitats, monthly samples have been taken in Block Island Sound, Narragansett Bay, and Green Hill Pond (a brackish lagoon), R.I. Observations include physical environmental properties, standing crop estimates, and fatty acid distribution in two size fractions - phytoplankton-microzooplankton and zooplankton. A second hypothesis states that the annual sample trajectory of a zooplankton community displayed in biochemical(fatty acid) phase space is related to production, but only under certain circumstances. Samples were also taken along the major axes of Ria de Arosa and Ria de Muros y Noya, two deep embayments on the Atlantic coast of northern Spain. Results on the first hypothesis show that each system in the gradient of environmental severity behaves individually during the autumnal cooling period, when plankton production declines to annual minima. Spatial distribution of zooplankton in the two adjacent Spanish rias differ completely, both qualitatively and quantitatively. A comparison between the Spanish rias and the three US estuaries should reveal the basic nature of chemically defined stable domain in community structure. From these relations, the fate of communities subjected to either natural stressors or anthrogenic perturbation may be predicted with economy, speed, and objectivity.

52159 (DP-MS—79-16) **Life history, development processes, and energetics of the burrowing mayfly.** Harvey, R.S.; Vannote, R.L.; Sweeney, B.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Academy of Natural Sciences of Philadelphia, PA (USA)). 1979. Contract EY-76-C-09-0001. 30p. (CONF-790734—1). P 03/MF A01.

From 3. international conference on ephemeroptera; Winnipeg, Manitoba, Canada (4 Jul 1979).

Dolania americana Edmunds and Traver is a burrowing mayfly known only from three coastal plain streams in the southeastern United States. In Upper Three Runs, a spring-fed blackwater stream in South Carolina, D. americana is the dominant mayfly species inhabiting the sandy substrate. Larvae are very distinct morphologically, being highly adapted for burrowing in sandy substrate. D. americana are predators and feed mainly on midge larvae. This paper describes quantitatively: (1) the bioenergetics and developmental dynamics of the larval stage; (2) adult emergence and fecundity; and (3) biochemical characteristics of the eggs. These data are used to delineate both the life history of D. americana and the overall importance of this species to energy flow in Upper Three Runs.

CHEMICALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 51054, 51060, 52108, 52147, 52148, 52158, 52220, 52221, 52223, 52229, 52230

52160 (CONF-7806143—) **International symposium on groundwater pollution by oil hydrocarbons.** Muzikar, R. (ed.). (Mezinarodni Hydrogeologica Asociace, Prague (Czechoslovakia)). 1978. 322p. U 14/MF A01.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Papers presented were divided into four groups: methods of hydrogeological exploration and decontamination of rock and groundwater contaminated by oils; movement of oils in groundwater and in rocks; chemical relations in the interaction system rock—groundwater—oils; and, location and area measurement of rock and groundwater oil contamination by surface methods (remote sensing, geophysics, geobotany). Those in scope for ERA/EDB were abstracted and indexed individually.

52161 (CONF-7806143—, pp 19-37) **Oil pollution of a chalk aquifer: a case history.** Hunter-Blair, A. (Anglian Water Authority, Huntigdon, England). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

In February 1976, an accidental spillage of 445 cubic metres of diesel fuel (Derv) occurred at an oil storage depot in southeastern England. The spill was in an area which, although bunded, had a permeable base lying directly upon a major unconfined chalk aquifer. Prompt action by the petroleum company enabled reclamation of 323 cubic metres of oil. The remaining 132 cubic metres penetrated the top soil and passed into the chalk so threatening the quality of a public water supply source approximately 665 metres away. The hydrogeology of the area of the aquifer was studied, and attempts were made to determine the distribution of the oil within the aquifer. About 113 m^3 of the remaining 132 m^3 were accounted for.

52162 (CONF-7806143—, pp 39-59) **Possibility of using hydrogeological samplers for waters contaminated with crude oil hydrocarbons.** Krajca, J. (Vyzkumny Ustav Geologickeho Inzenyrstvi, Brno, Czechoslovakia). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Various devices for sampling natural waters in boreholes and wells were tested for application to the sampling of waters contaminated with toxic substances, including crude oil. The devices of the type series tested are: bottle type sampler LV-150, floor sampler PV-70, high-pressure floor sampler PVV-38, and piston type sampler phi 70. The operational application of all types of samplers of the type series in bore holes with crude oil substances floating on the level, requires the lowering through an auxiliary piping, which is provided at the top with a controllable, hermetic closure against the penetration of crude oil substances. Under this precondition, the application of the modified instrument PV-70 with a neck and namely the

application of the piston type instrument phi 70 appeared very realistic. For the regime draws from stagnant bore holes, a simple type of a portable sampler must be developed with the sample drawing directly into a transport bottle, and such a sampler should be used only once at the draw point. Repeated draws from the same level of a bore hole would be carried out for the purpose of verifying the reproducibility of the sampling always with a new instrument, the content of which would be transported without any pouring over directly to laboratories for analyses. Here a high quality decontamination would be accomplished. With regard to a higher investment cost for samplers of the type series, these are not suitable for such use. For this reason, it will be necessary to transport in the field a set of simple samplers in special transport cases, specially cleaned and specially applicable instruments. These circumstances also determine the directions in the designs, i.e., limiting the weight, the principles of the equipment, and also the bottle capacities or the depth of the application to approximately 50 m.

52163 (CONF-7806143—, pp 61-71) **Hydraulic protection of groundwaters against oil substances.** Pelikan, V. (Vyzkumny Ustav Geologickeho Inzenyrstvi, Brno, Czechoslovakia). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

The term hydraulic protection comprises those measures taken to protect groundwaters that bring about an artificial change of slope relations of the groundwater level in order to prevent the spread of pollution and in order to be able to pump away from the rocks the polluted water and the pollutants. The basic element of the hydraulic protection is the pumping (in-taking) well or a seepage well. The latter are usually taken use of only in connection with the former, the task of the hydraulic protection being the removal of the pollution. Experience with the operation of the hydraulic protection system is discussed. The value of the 24,000 tons of oil returned to production exceeded the cost of pumping. (JGB)

52164 (CONF-7806143—, pp 73-81) **Application of soil air analysis in order to determine the extent of groundwater contamination due to petroleum products.** Pelikan, V.; Kucera, M.; Polenka, M. (Vyzkumny Ustav Geologickeho Inzenyrstvi, Brno, Czechoslovakia). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Methods for sampling and analyzing for the volatile components of an oil spill in soils and rocks are discussed. Soil air analyses can be helpful in determining the extent of a spill and as a safety precaution in areas where oil products with high content of low-boiling hydrocarbons are present. (JGB)

52165 (CONF-7806143—, pp 83-89) **VAPEX: a new sorbent protecting environments and water against pollution by oil products.** Svigar, L. (Keramicke Zavody, Kosice, Czechoslovakia). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

The properties of the hydrophobized pearlite sorbent product manufactured under the trade name VAPEX are discussed. Vapex, which is used in cleanups of hydrocarbon liquid spills, is a loose granular product consisting essentially of expanded pearlite and resembling glass by its physical and chemical nature. The individual grains of Vapex contain a high amount of open and closed pores; the bulk weight of Vapex varies in the range of 50 to 250 kg/m^3. The grain and pore surfaces are coated with a non-wetting coating. The expanded pearlite itself can be easily wetted by polar and non-polar liquids and readily absorbs them. Vapex may be used for the purpose of oil adsorption in dry media, on water surfaces, and to adsorb water-dispersed oils. Examples illustrating the cleanup of contaminated water are included.

52166 (CONF-7806143—, pp 107-125) **Behavior of oil in fissured rocks: demonstrated by typical oil incidents.** Birk, F.; Vorreyer, C. (Institut fuer Angewandte Geologie, Bochum, Germany). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

The behavior of oil in fissured rocks is illustrated by three case studies. Case A deals with a border-line case between porous and fissured media. As the result of the greater loosening of the groundwater bearing zone, the rocks have a high permeability, demonstrated by the high velocity of groundwater flow, and are nearly an isotropic media. Because of the large openings and strong falling gradients, the oil, however, runs off to the receiving stream in a direct way, without contaminating a larger area. The Cases B and C are more typical to show contamination of fissured aquifers. The deviation from the behavior of oil in porous media is characterized. The oil migration doesn't take a uniform areal course as in porous media but on preferred joint cracks, pursuing in single cases considerable quantities of oil. Joint planes traversal to the groundwater flow often have the effect of trash boards. They retain the oil or at least deflect the oil in other directions. This often leads to a greater thickness of oil layers on the groundwater, by concentration of oil, than in porous media. In porous media fluctuations of the groundwater level cause during the oil migration a diminution of oil spreading. The oil follows the groundwater increase or lowering. To the contrary, in fissured rocks, phreatic fluctuations can open new ways of flow, so that a new one mobilization of oil follows. Accordingly, the oil contents of the groundwater fluctuate much more than in porous medium. Quantitative data about oil retention capacity or thickness of oil layer cannot be derived from the described cases, because in all cases neither the infiltrated oil quantities were well known nor was the recovery complete. Because of the insignificant porosity and the smaller effects of capillarity in joints the oil retention is clearly smaller than in loose rocks of comparable permeabilities. (JGB)

52167 (CONF-7806143—, pp 127-137) **Theoretical considerations and practical implications on the infiltration of hydrocarbons in aquifers.** Dracos, T. (Eidgenoessische Technische Hochschule, Zurich, Switzerland). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

The sequence of events occurring after a sudden spillage of oil involves three phases. The oil infiltrates vertically under the influence of the gravitational force. If the quantity of the spill is large enough and its duration long enough, the oil can reach the groundwater level. After this, pressure builds up under the influence of which the oil spreads radially in the horizontal direction, as well as vertically by displacing the water. Since the oil quantity is limited, this pressure decays after some time. In the last phase of the spread, the oil moves in the direction of the groundwater flow due to the slope of the water level. The motion of the oil decreases exponentially and ceases when the residual saturation in oil is reached. The time scales of the three phases described above are quite different from one another. The vertical infiltration generally ends in a few hours time. The radial spread may last for days or weeks; the last phase for months or even years. Calculations indicate that the spread of oil in naturally deposited soils can be estimated roughly. Based on such estimates, it should be possible to choose adequate restorative measures. These measures will generally only be successful if they are taken during the first and second phase of the oil spread. (JGB)

52168 (CONF-7806143—, pp 139-147) **Dispersion scheme in the general mechanisms of groundwater pollution by hydrocarbons.** Fried, J.J. (Universite Louis Pasteur, Strasbourg, France); Zilliox, L. 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Hydrodynamic dispersion is an important mechanism of pollution propagation in groundwater. A number of fundamental concepts are presented in order to help analyze the elementary mechanisms of the oil product behavior in the aquifer. It is concluded that groundwater pollution by hydrocarbons is actually linked to the possible washing of an impregnation body of oil by the aquifer, the dissolution of some hydrocarbons, and the carrying away of the dissolved hydrocarbons or of light particles of hydrocarbons. The pollution source is the area of contact between oil and water. The major mechanism of this pollution is dispersion—convection, which governs its movement, carrying, spreading, and diffusing the hydrocarbon traces. Chemical and physical phenomena modify the purely dispersive movement of the pollution, through adsorption, biochemical decay and evaporation, with various effects, sometimes beneficial (when a degradation is observed, for instance), sometimes detrimental (when adsorption delays pollution, but may give way to some reactivations of the pollution, for instance). (JGB)

52169 (CONF-7806143—, pp 149-154) **Hydrogeological investigation and predictions of groundwater oil pollution.** Goldberg, V.M.; Melkonavitskaya, S.G. (National Committee of Geologists, Moscow, USSR). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Various conditions of groundwater contamination are discussed. Methods for determination of oil and oil products in water include: non-specific methods for a quantitative evaluation; methods with group specific features in relation to different hydrocarbon classes of oils applied to a quantitative evaluation and identification (spectral methods); and, highly specific methods with reference to individual components of oil suitable for intentification and quantitative evaluation (gas chromatography alone and in combination with mass-spectrometry). Bases for selection of the most suitable method are discussed.

52170 (CONF-7806143—, pp 155-161) **Induced spreading of oil spills.** Knezek, J. (Stavebni Geologie, Prague, Czechoslovakia). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Various means of contamination of groundwater, as well as the phases and mechanisms of dispersion, are reviewed. The kinetics of induced distribution is examined, and methods of evaluation of induced changes are summarized. (JGB)

52171 (CONF-7806143—, pp 163-165) **Movement of oils from landfills and its effect on groundwater quality.** Mather, J.D.; Day, J.B.W. (Institute of Geological Sciences, London, England). 1978.
From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Research on the physico/chemical processes that occur in and beneath landfills is reported. During this research a number of landfill sites were examined, containing mineral oils and wastes arising from the handling, refining, chemical processing, distribution, and subsequent use and reclamation of oils. In addition, laboratory studies were undertaken in order to gain a better understanding of the breakdown and behavior of oils and their products in landfill conditions. Some results from these studies are presented, and tentative conclusions on the processes that retard oil movement from landfills and on the measures which can be taken to minimize groundwater pollution problems are given. Both the simulated landfill experiments and the investigations around existing landfill sites suggest that adsorption processes are the most significant in retarding the movement of mineral oils as they migrate through solid wastes and unsaturated strata beneath landfills. Oily wastes discharged to lagoons have migrated significant distances both within a thin saturated glacial sand aquifer and within a shale/sandstone succession where storage has been increased by mining. In both these cases the oil migration occurred because the landfill was overloaded with far greater volumes of oil than could be adsorbed within the underlying solid wastes and/or bedrock. Landfill sites where there is likely to be hydraulic continuity between lagoons and the water table in the underlying formation should be avoided as should sites where fissure flow can result in rapid migration of oil. In these cases or where large volumes of oil or oil/water emulsion are discharged, exceeding the absorbent capacity of the underlying strata and solid wastes, a deterioration of groundwater quality will result which will be the more severe since the immiscibility of oil and water precludes dilution.

52172 (CONF-7806143—, pp 167-181) **Calculations and experimental investigations of the migration of oil products in natural soils.** Mull, R. (Institut fuer Wasserwirtschaft, Hannover, West Germany). 1978.
From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Calculations of the migration of oil in the subsoil must be based on the assumption of homogeneous conditions. The heterogeneity of the soil and the oil distribution can only be taken into consideration by rough estimations. The longer the oil is located in the groundwater-bearing stratum, the less is the concentration; the more it is distributed by the fluctuation of the groundwater table, the more the heterogeneity of the porous medium influences the migration. The knowledge about the permeability saturation function diminishes with increasing saturation values.

52173 (CONF-7806143—, pp 183-207) **Rate of spread of petroleum products.** Sellberg, B. (SIFU-Enheten, Stockholm, Sweden). 1978.
From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Experiments were performed in the field with fuel oil No. 1 and petrol to determine the way in which these hydrocarbons spread in some common unconsolidated deposits in Sweden, such as esker material, bottom varves of glacial clay, and sand on clay. In the investigations the rate of speed of fuel oil No. 1 was varying from 0.1 to 0.2 m/d up to 1.0 to 1.6 m/d. Petrol showed lower speed, i.e., 0.03 to 0.04 m/d to c. 0.09 m/d. Experiments covering a longer period showed that the maximum concentration diminished significantly in transport up to a distance of about 20 m.

52174 (CONF-7806143—, pp 235-251) **Ground air measurements as a tool for mapping and evaluating organic groundwater pollution zones.** Albertsen, M.; Matthess, G. (Univ., Kiel, Germany). 1978.
From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Carbon dioxide concentrations in the ground air of four natural test fields, a coniferous forest, leafy wood, grass glade, and sugar-beet field, were compared with measurements in ground air above a pollution plume issuing from an industrial waste site. Results indicate that under natural conditions the biologically active zone is the main source of carbon dioxide in the soil and controls its vertical distribution. The data from the polluted groundwater plume at the waste site show groundwater as second source. The microbial decomposition of organic matter in the polluted groundwater releases carbon dioxide into the ground air. Measurement of the carbon dioxide concentration anomalies in the ground air can be used as tool for mapping groundwater pollution zones. For an exact evaluation the concentrations and concentration gradient distributions of carbon dioxide beneath the biologically active soil zone are measured. As an example of this mapping method the results of a groundwater study are presented. The method, which involves vertical CO_2 and water content measurements, proved to be a feasible and inexpensive tool for determining the extent of groundwater pollution by biodegradable organic substances. (JGB)

52175 (CONF-7806143—, pp 253-265) **Large scale experiments on groundwater pollution by oil spills: interim results.** Dietz, D.N. (Technische Hogeschool, Delft, Netherlands). 1978.
From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Previous studies established that spilled oil will settle at residual saturation in a pancake on top of the groundwater (the groundwater level at the time of the spill). The fraction of the rainfall within a water catchment area that feeds the groundwater via the pancake will originate a narrow stream of polluted groundwater within the total groundwater flow. The natural decay of the unmitigated pollution was studied as it will occur in this narrow stream. Results indicate that rainfall, percolating through the pancake on its way to the groundwater body will dissolve oil components to concentrations of 1 to 10 ppM, depending on solubilities. Hydrocarbons in the pancake are subject to aerobic and anaerobic oxidation. The oxidized products are sufficiently soluble and bring the organic carbon content of the water up to roughly 50 ppM, depending on the nature of the oil and on the prevailing temperature. Organic carbon content, mainly due to these oxygen-containing organic compounds, is reduced by anaerobic oxidation to a fraction of 0.5 to 0.1 after a travel time of two years. At the same time, inorganic carbon content goes up, demonstrating a significant rate of ultimate decay of the pollutants. In spite of this decay the taste numbers rise to about 20,000. Except in one lysimeter, they have not yet shown signs of going down. It is concluded that, in the last stages of stepwise oxidation, small concentrations of the most obnoxious compounds prevail. No barrier to ultimate decay of the pollutants having been observed, the taste numbers should ultimately come down, but they will do so only in the very last stage. This stage is now expected to fall beyond the originally planned 3 years duration of the tests. As taste of groundwater, destined for drinking water, is by far the most important property, plans are being developed to extend the period of observation.

52176 (CONF-7806143—, pp 267-277) **Closed-loop stripping procedure with glass capillary gas chromatography applied as effective way for the study of hydrocarbons in ground- and surface waters.** Hassler, J. (Vyzkumny Ustav Vodneho Hospodarstva, Bratislava, Czechoslovakia). 1978.
From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

At the present state of the art the overall results of the study confirmed that stripping technique and the technique of preparation of capillary columns according to Grob are suitable for the identification of pollutants and characterization of various types of water with volatile organic constituents. It can be considered as one of the best elaborated methods for the determination and separation of trace quantities of organic substances in the water management, water resources development, survey, and decontamination activity. The examples of analysis of infiltrated water from the Danube and Glatt rivers show the composition of organic matter occurring within the environment due to human activity and man's intervention.

52177 (CONF-7806143—, pp 279-288) **Alterations of the petroleum substance in rock—water—air and rock-water systems.** Houzim, V. (Stavebni Geologie, Prague, Czechoslovakia). 1978.
From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

In addition to the simple spread of petroleum products, various physical, physico-chemical, chemical, and microbial processes take place in the aeration and the water saturated zones of the rock environments. Upon seepage of the petroleum product into the subsoil, another phase, the liquid phase of the petroleum product, enters the native two- and three-phase rock/soil/—water and rock/soil/—water--air systems. Interaction of the petroleum product with the system takes place in processes that have a complex course and are a function of time. The velocity of the processes is affected by the properties of the rocks and soils by those of the petroleum products, and by conditions prevailing in the rock medium as are temperature, pressure, varying oxygen content, lack of light and

microbial activity. The following time-dependent processes can take place upon infiltration of the petroleum product into the naturally occurring systems of the rock medium: sorption on soils and rocks, evaporation of the volatile hydrocarbons, dissolution of the native organic matter in the petroleum product, selective desorption and dissolution of the petroleum product in water (gravitational water and groundwater), emulsification and demulsification of the petroleum product in water, and chemical oxidation and reduction, possibly with the assistance of microorganisms and microbial degradation proper.

52178 (CONF-7806143—, pp 289-301) **Dynamics of motion and alteration in quality of petroleum hydrocarbons in soil and water environment.** Lehotsky, J. (Vyskumny Ustav Vodneho Hospodarstva, Bratislava, Czechoslovakia). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Petroleum hydrocarbons occur in the soil in several forms, including gases, liquids, heavy and light fractions, and dissolved and emulsified forms in aqueous solutions. Methods for the analysis of petroleum hydrocarbons in the water—soil environment are reviewed. Included are gas chromatography, spectrophotometry, and gravimetry. (JGB)

52179 (CONF-7806143—, pp 303-306) **Determination of petroleum products in water.** Zelinkova, D.; Weidenhoffer, Z. (Stavebni Geologie, Prague, Czechoslovakia). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Use of the following methods for the sensitive and precise determination of oil products in water is discussed: automatic carbon-content analyzer, ir spectrophotometry, gas chromatography, mass spectrometry, and solvent extraction. (JGB)

52180 (CONF-7806143—, pp 309-317) **Location and area measurement of rock and groundwater oil contamination by surface methods.** Svoma, J. (Stavebni Geologie, Prague, Czechoslovakia). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Non-destructive methods of detecting oil spills are reviewed. Geobotanical and geophysical electrical methods have had a long tradition in geological prospecting; at the present time they can be applied, in principle, to search for and to delineate oil spills. Photography is in its early stage of research in order to establish its practical use in detecting oil products. While substantial problems are not to be expected when applying infrared color photography do detect gaseous hydrocarbons, the problem of the feasibility of photoindications of pollutions caused by liquid hydrocarbons remains unsolved. High-quality spectrophotometers, spectroradiometers and infrared thermal scanners are too expensive to be available at each of the prospecting organizations. It seems to be more advantageous to equip one laboratory with peak instrumentation allowing to accomplish the basic spectrometric and thermometric measurements. Of the techniques not tested so far, radar, contactless thermometry or microseismics can be of importance for locating the presence of oil under ground. The application of nonphotographic remote sensing from satellites does not seem probable so far.

52181 (CONF-7806143—, pp 319-330) **Aid of geophysical methods in oil spill cleanups.** Dolezal, J. (Stavebni Geologie, Prague, Czechoslovakia). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

The feasibility of the use of geophysical methods in cleaning up oil spills is briefly surveyed. The geophysical methods, in combination and cooperation with other disciplines, supply a series of positive results aiding in the fast and efficient cleanup of oil spills.

52182 (CONF-7806143—, pp 331-349) **Use of remote sensing and ground control in monitoring oil fields in Alabama.** La Moreaux, P.E. 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

Present and future water pollution problems resulting from oil field operations in Alabama are analyzed. An outline of a program of data collection and interpretation necessary to determine and evaluate solutions to these problems is presented. A method of adequate monitoring of the oil and gas fields in Alabama to protect against pollution of its valuable surface and groundwater supplies is described. Samples of brine are continuously collected and analyzed from sources representing all water producing horizons in the oil fields. A network of observation wells has been established in oil fields to periodically determine changes in the chemical quality of groundwaters. Water samples from wells adjacent to all major saltwater evaporation pits have been collected and analyzed for possible changes in chemical quality. Discharge measurements are made on streams adjacent to all oil fields. Periodic aerial photographs are being made of each field. Preliminary administrative reports are regularly prepared on each problem in the oil fields and remedial or disciplinary actions are taken by the Oil and Gas Board.

52183 (CONF-7806143—, pp 351-361) **Application of vertical electrical sounding in treating the problems of groundwater contamination by petroleum hydrocarbons.** Mazac, O. (Geofyzika, n.p., Prague-Smichov, Czechoslovakia); Landa, I. 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

When treating problems related to cleanup operations and groundwater protection against petroleum hydrocarbons, geoelectrical surface prospecting methods can play an important role, provided that the geophysicist is conscious of the feasibility of these methods as far as the accuracy of the required data is concerned. Geoelectrical methods can be used both for direct determinations of the degree of groundwater contamination by petroleum products and for collecting information about various hydrogeological parameters useful with the view of performing efficient cleanup operations. However, the feasibility and the limits of geoelectrical methods in evaluating pollution occurrence and extent are rather restrained. They can be utilized only under certain conditions depending upon the physics and the geometry of the geoelectrical layers representing the rock medium and also depending upon the electrode array.

52184 (CONF-7806143—, pp 363-377) **Geobotanical and photographical indication of oil spills.** Pysek, A.; Svoma, J. (Stavebni Geologie, Prague, Czechoslovakia). 1978.

From International symposium on ground water pollution; Prague, Czechoslovakia (Jun 1978).

It is concluded that geobotanical methods are suitable for detecting oil seepages in general. Poorer results can be expected when conducting operations in arable land. The results of the photographic survey method are promising, but not unambiguous. In addition to objectively limiting natural factors, its low stage of development shows up unfavorably in application. Working hypotheses indicate that the optimum application of the method could be realized by air photo surveys of horizontally extending potential seepages of petroleum hydrocarbons from leaking pipelines.

52185 (IVL-B—489) **Fluxes of mercury through surfaces of lakes.** Svedung, I. (Swedish Water and Air Pollution Research Lab., Stockholm). Feb 1979. 29p. (In Swedish). U 03/MF A01.

The study includes both the chemical forms of mercury which occur in air and how these could be absorbed and emitted by the surface of a lake. Measurements at the Lake Nedre Fryken, Sweden, during autumn and winter, 1978/79 show that considerable amounts of the content of mercury in the air are oxidized forms of mercury, i.e. Hg^{2+} and methyl Hg^{+}. It has been shown that both the water of lakes and solutions prepared from distilled water absorb oxidized forms of mercury. In the aqueous phase they are reduced and reemitted to the air. According to calculations the absorbtion of mercury at surfaces of lakes by the reciprocal action between air and water are of the same order as the direct deposition at the surfaces due to rain.

RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 52144, 52152, 52153

52186 (DPSPU—79-30-9) **Tritium in the environment at the Savannah River Plant.** Ashley, C.; Zeigler, C.C.; Quinsenberry, D.R. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jul 1979. Contract EY-76-C-09-0001. 8p. (CONF-790728—3). P 02/MF A01.

From 24. annual meeting of the Health Physics Society; Philadelphia, PA, USA (7 Jul 1979).

As part of the tritium monitoring program, atmospheric moisture, rainwater, and other media are routinely monitored at the Savannah River Plant (SRP), a major producer of tritium in the United States. A mathematical model to predict tritium concentrations in air and rainwater at distances up to 40 km from the emission source was developed using empirical data from the SRP environmental monitoring program and standard statistical techniques. Curvilinear regression analysis of the relationship between tritium concentrations and distance from the release points was used to develop an equation to represent the data. Comparison of calculated vs. measured concentrations and depositions of tritium show good agreement.

AQUATIC ECOSYSTEMS AND FOOD CHAINS

52187 (PNL—2960) **Food web transport of trace metals and radionuclides from the deep sea: a review.** Young, J.S. (Battelle-Northwest, Sequim, WA (USA). Marine Research Lab.). Jun 1979. Contract EY-76-C-06-1830. 32p. P 03/MF A01.

This report summarizes aspects of the potential distribution pathways of metals and radionuclides, particularly Co and Ni, through a biological trophic framework after their deposition at 4000 to 5000 meters in the North Atlantic or North Pacific. It discusses (a) the basic, deep-sea trophic structure of eutrophic and oligotrophic regions; (b) the transport pathways of biologically available energy to and from the deep sea, pathways that may act as accumulators and vectors of radionuclide distribution, and (c) distribution routes that have come into question as potential carriers of radionuclides from the deep-sea bed to man.

THERMAL EFFLUENTS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 52220, 52232

SITE RESOURCE AND USE STUDIES

REFER ALSO TO CITATION(S) 51058

52188 (RHO-CD—742) **Environmental report of Purex Plant and Uranium Oxide Plant - Hanford reservation.** (Atomics International Div., Richland, WA (USA). Rockwell Hanford Operations). Apr 1979. Contract EY-77-C-06-1030. 155p. P 08/MF A01.

A description of the site, program, and facilities is given. The data and calculations indicate that there will be no significant adverse environmental impact from the resumption of full-scale operations of the Purex and Uranium Oxide Plants. All significant pathways of radionuclides in Purex Plant effluents are evaluated. This includes submersion in the airborne effluent plumes, consumption of drinking water and foodstuffs irrigated with Columbia River water, ingestion of radioactive iodine through the cow-to-milk pathway, consumption of fish, and other less significant pathways. A summary of research and surveillance programs designed to assess the possible changes in the terresstrial and aquatic environments on or near the Hanford Reservation is presented. The nonradiological discharges to the environment of prinicpal interest are chemicals, sewage, and solid waste. These discharges will not lead to any significant adverse effects on the environment.

52189 (SAN—0034/263-1) **National energy policy and state coastal programs: a critique of current efforts to balance environmental protection and energy production along the coast.** Kanouse, R.; Sorensen, J. (California Univ., Berkeley (USA); California Univ., San Diego (USA)). Apr 1979. Contract EY-76-S-03-0034-263. 394p. P 16/MF A01.

The Coastal Zone Management Act (CZMA) represents an effort to improve state management of coastal resources in siting of energy facilities while reducing the costs of redundant regulation. There is evidence that, state coastal programs have not had a major impact on the siting regulatory process. The Coastal Zone Management Act expires in 1980, and Congressional hearings to consider extension of the CZMA are scheduled for the Fall of 1979. It is stated that congress must amend the current provisions of the Act that deal with regulation of coastal energy facility siting activities, since re-enactment of the current siting provisions would be an endorsement of the present ineffective regulatory process. Eight major modifications that should be made in the CZMA are proposed. The first four modifications focus upon clarifying key provisions in the current Act. The latter four modifications focus upon attributes of the energy facility siting regulatory process that are either ignored or inadequately addressed in the current CZMA. These four proposed modifications are designed to minimize the impediments to an effective and efficient siting process that are caused by the inherent complexities of national energy policy and environmental Protection programs. Two legislative options for amending the CZMA, both of which incorporate the eight suggested modifications, are proposed.

52190 **Soil and Water Resources Conservation Act of 1977. Hearings before the Ninety-Fifth Congress, First Session.** Washington, DC; Committee on Agriculture (1977). 25p. I .

H.R. 75 would establish a mechanism for making long-range policy to encourage the wise and orderly development of the nation's soil and water resources. The bill requires the Secretary of Agriculture to prepare an appraisal of the nation's soil, water, and related resources not later than December 31, 1979, and at each five-year interval thereafter during which this Act is in effect. It also requires the Secretary to develop a National Soil and Water Conservation Program not later than December 31, 1979, and to update it at each five-year interval thereafter during which this Act is in effect. The program is to set forth the direction for future soil and water conservation efforts of the US Department of Agriculture; and shall include but not be limited to: (A) an analysis of existing Federal, State and local government authorities and adjustments needed with respect thereto; (B) an evaluation of the effectiveness of ongoing soil and water conservation programs and the progress being achieved by Federal, State and local programs and the land owners and users in meeting the conservation objectives of this Act; (C) an identification and evaluation of, and recommendations relating to, alternative methods (within alternative time frames) for the conservation, protection, and environmental improvement and enhancement of soil and water resources and the extent to which they are being implemented; (D) an analysis of costs and benefits of alternative soil and water conservation practices; (E) an investigation and analysis of alternative irrigation techniques regarding their costs, benefits, and impact on soil and water conservation, crop production, and environmental factors; and (F) an analysis of the feasibility of collecting organic waste materials from a variety of origins, treating these wastes, and transporting them to farms and rural areas where they would be used to improve soil fertility. Proposed amendments to the bill are presented.

SOCIAL AND ECONOMIC STUDIES

REFER ALSO TO CITATION(S) 51456, 51784

ASSESSMENT OF ENERGY TECHNOLOGIES

REFER ALSO TO CITATION(S) 51424, 51784

BIOMEDICAL SCIENCES, BASIC STUDIES

BEHAVIORAL BIOLOGY

REFER ALSO TO CITATION(S) 52157, 52159, 52197, 52199, 52200, 52202, 52203

52191 (COO—1332-131) **Vertebrate behavior and ecology. Progress report, 1 July 1978—30 June 1979.** Tester, J.R.; Siniff, D.B. (Minnesota Univ., Minneapolis (USA)). Jul 1979. Contract EY-76-S-02-1332. 80p. P 05/MF A01.

Efforts in engineering design and development this year emphasized improvement in the quality and versatility of radio transmitters, use of microprocessors in an automated fish tracking system, and construction of an automated system to monitor movements and activities of aquatic mammals in response to water temperature. Improved radio transmitters were used on a variety of species including sea otters, manatees, and wall-eyed pike. The fish tracking system, installed at Monticello, Minnesota, will next be modified for monitoring marine mammal movements. The temperature data logging system was tested on manatees in the St. John River near Blue Springs, Florida. The long-term goal in the subproject on evaluation of census methods is to utilize the extensive experience, technology, and equipment developed over the years in radio telemetry to resolve basic problems in animal census and population study methods. During the past year, efforts have resulted in information on activity patterns and the behavioral repertoire of sea otters and on the response of otters to contamination by Alaskan crude oil. Three preliminary manuscripts presented as part of this report describe these aspects in detail.

BIOCHEMISTRY

REFER ALSO TO CITATION(S) 52037, 52039, 52040, 52049, 52051, 52054, 52158, 52194, 52206, 52207

52192 (COO—1599-153(Pt.4)) **Carbonic anhydrase levels and internal lacunar CO_2 concentrations in aquatic macrophytes.** Weaver, C.I. (Michigan State Univ., East Lansing (USA). Dept. of Botany and Plant Pathology). 1979. Contract EY-76-S-02-1599. 90p. P 05/MF A01.

Thesis.

Carbonic anhydrase levels were examined in a variety of aquatic macrophytes from different habitats. In general, carbonic anhydrase levels increased across the habitat gradient such that

activities were low in submersed aquatic macrophytes and high in emergent macrophytes with floating-leaved and free-floating plants exhibiting intermediate activities. Internal lacunar CO_2 concentrations were analyzed in relation to carbonic anhydrase activities. There was no correlation between these two parameters. Internal CO_2 concentrations ranged from low to high in submersed macrophytes, but were low in floating-leaved and emergent macrophytes. The observed internal CO_2 concentrations are discussed in relation to the individual morphologies of the plants and the environments in which they occurred.

TRACER TECHNIQUES

REFER ALSO TO CITATION(S) 52217

52193 (LA-UR—79-1648) **Architecture and dynamics of isotopically labelled macromolecules by nuclear magnetic resonance spectroscopy.** Matwiyoff, N.A. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 27p. (CONF-790680—1). P 03/MF A01.

From NATO A.S.I. series on ESR and NMR of paramagnetic species in biological and related systems; Acquafredda di Maratea, Italy (Jun 1979).

The use of ^{13}C is considered using NMR spectra of cell suspensions. Biochemical reaction kinetics are still unclear in the study of environmental and structural perturbations of amino acids and peptides; thus needs still exist for this labelling technique. (PCS)

CYTOLOGY

REFER ALSO TO CITATION(S) 52107, 52198, 52206, 52212, 52214, 52233

52194 (BNL—26282) **Determining biological fine structure by differential absorption of soft x-rays.** Panessa-Warren, B.J.; Warren, J.B. (State Univ. of New York, Stony Brook (USA); Brookhaven National Lab., Upton, NY (USA)). Jun 1979. Contract EY-76-C-02-0016. 23p. (CONF-790674—3). P 02/MF A01.

From Conference on ultrasoft X-ray microscopy; New York, NY, USA (13 Jun 1979).

The use of soft x-ray contact microscopy in examining histochemically treated human tissue embedded in plastic and exposed as unstained thin sections is demonstrated. When our preliminary data revealed that we could clearly image not only the histochemical reaction product, but the unstained biological fine structure of the surrounding tissues, we decided to test our hypothesis further and see if we could image unstained biological molecular aggregates as well. For this part of the investigation, we chose to examine hydrated proteoglycan aggregates. Proteoglycans are an essential component of the organic matrix of cartilage, and play a primary role in the retention and maintenance of extracellular water. To avoid any artifacts due to the introduction of exogeneous materials, and examine the proteoglycan aggregates in their hydrated, natural configuration, we made contact x-ray images of isolated proteoglycan aggregates in water.

52195 (CONF-790537—1) **CHO/HGPRT mutagenicity assay. III. Adaptation for mutagen screening.** O'Neill, J.P.; Hsie, A.W. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 13p. P 02/MF A01.

From Cold Spring Harbor symposium on quantitative mammalian cell mutagenesis and mutagen screening; Cold Springs Harbor, NY, USA (6 May 1979).

This assay system has been employed for a variety of quantitative studies of mutation induction in mammalian cells (Hise et al., 1978). The development of interest in utilizing this system for mutagen screening has prompted us to evaluate those aspects of the system which necessitate the largest time and monetary investments, and to investigate the possibilities of applying insights gained from our basic research program to optimize use of the system for routine testing procedures. This paper describe our progress in the areas of phenotypic expression time and the density dependent recovery of mutant colonies in selective medium.

52196 (RERF-TR—1-78) **Agarose plate method for the study of human T and B lymphocyte migration.** Pinkston, J.A.; Finch, S.C.; Iida, S.; Caplan, R.A. (Radiation Effects Research Foundation, Nagasaki (Japan). Nagasaki Branch; Radiation Effects Research Foundation, Hiroshima (Japan)). Jun 1978. Contract EX-76-C-28-3161. 10p. (In Japanese and English). P 10/MF A01.

An agarose plate method is described for measuring the random migration of human T and B lymphocytes. Migration studies on separate human T and B lymphocyte populations demonstrated striking differences in migration patterns and cell morphologic characteristics. The technique is suitable for studying the effects of chemokinetic and chemotactic factors on the migration of lymphocyte subpopulations.

52197 (RERF-TR—8-78) **Chromosome heteromorphisms in the Japanese. 1. Banding patterns of Dp+ and Gp+ by Q- and C-staining methods.** Sofuni, T.; Tanabe, K.; Awa, A.A. (Radiation Effects Research Foundation, Hiroshima (Japan); Radiation Effects Research Foundation, Nagasaki (Japan). Nagasaki Branch). Feb 1979. Contract EX-76-C-28-3161. 14p. (In Japanese and English). P 04/MF A01.

Thirty-four cases with Dp+ amd Gp+, known to be chromosome heteromorphisms in man, were examined using Q- and C-staining methods. Of 18 cases with Dp+, 14 involved No. 15 chromosome and 2 each were No. 13 and No. 14 respectively. Of 16 cases with Gp+, 13 were concerned with No. 22 and the remaining 3 were No. 21. Short arm regions of eight cases with 15p+ and one with 14p+ were stained very darkly by the C-method, but did not fluoresce brilliantly by the Q-method. On the other hand, brightly fluorescing short arm regions observed in three cases with 15p+ and two with 22p+, were not very darkly stained by the C-method. In the remaining 20 cases, short arm regions were not stained positively by either method, but showed negatively or intermediately variable staining intensities.

GENETICS

REFER ALSO TO CITATION(S) 52224, 52228, 52238

52198 (CONF-790537—4) **CHO/HGPRT mutagenicity assay. I. Experimental procedure.** O'Neill, J.P.; Hsie, A.W. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 18p. P 02/MF A01.

From Cold Spring Harbor symposium on quantitative mammalian cell mutagenesis and mutagen screening; Cold Springs Harbor, NY, USA (6 May 1979).

Efforts to develop such a system utilizing Chinese hamster ovary (CHO) cells and the purine analogue 6-thioguanine (TG) to quantify mutation induction at the hypoxanthine (Hx)-guanine phosphoribosyl transferase (HGPRT) locus are described. These studies include the definition of such parameters as medium, mutagen treatment conditions, subculture protocol, phenotypic expression time, and optimal conditions for selection of the mutant phenotype. The selection conditions have been established in terms of medium, serum, concentration of selective agent, and cell density. The system has been used to determine the mutagenicity of various physical and chemical agents.

52199 (SAN—0326/33-1) **Mutation rates and mutational loads in man. Annual progress report of scientific activity.** Cavalli-Sforza, L.L. (Stanford Univ., CA (USA). Dept. of Genetics). 1979. Contract EY-76-S-03-0326-033. 10p. P 02/MF A01.

Gene frequency maps of the world have been prepared by computer for 39 alleles at nine loci, including HLA genes A and B. Also maps of principal components of gene frequencies have been made, representing overall similarities between aboriginal populations of the world for available genetic markers. A discriminant analysis of the data has indicated some effect of latitude, which is likely to be due to selective effects of climate.

METABOLISM

REFER ALSO TO CITATION(S) 52159

MEDICINE

REFER ALSO TO CITATION(S) 52202

52200 (RERF-TR—7-78) **Autopsy study of small cardiac scars in Japanese men who lived in Hiroshima, Japan and Honolulu, Hawaii.** Steer, A.; Lee, S.S.; Stemmermann, G.N.; Yamamoto, T.; Rhoads, G.G.; Lee, K.K. (Radiation Effects Research Foundation, Hiroshima (Japan); Radiation Effects Research Foundation, Nagasaki (Japan). Nagasaki Branch). Oct 1978. Contract EX-76-C-28-3161. 15p. (In Japanese and English). P 02/MF A01.

Japanese men long resident in Honolulu, Hawaii have significantly more ischemic heart disease, but significantly fewer small cardiac scars than men in Hiroshima, Japan. These scars occur in three forms: (1) small scars in the mural myocardium which account for the difference in frequency of small lesions in the two cities, and are of uncertain etiology; (2) areas of diffuse fibrosis in the papillary muscles. These are equally frequent in the two cities, and are associated with advancing age and sclerosis of papillary muscle arteries; and (3) focal scars in the papillary muscles. These are more

frequent in Honolulu than Hiroshima. They are healed infarcts due to ischemic heart disease and are associated with a severe degree of extramural coronary artery sclerosis. Small mural myocardial scars, when present, are usually found in multiple sites, and are not related to age at death or heart weight. They are more common in the presence of sclerosis of intramural small arteries, but this association does not explain their more frequent occurrence in Hiroshima. There is no evidence that they are related to A-bomb radiation exposure.

UNSEALED RADIONUCLIDES IN DIAGNOSTICS

REFER ALSO TO CITATION(S) 52063

EXTERNAL RADIATION IN DIAGNOSTICS

52201 (RERF-TR—3-77) **Foreign bodies radiographically demonstrated in atomic bomb survivors.** Tamura, S.; Onitsuka, H.; Lee, K.K.; Shimizu, Y.; Russell, W.J. (Radiation Effects Research Foundation, Nagasaki (Japan). Nagasaki Branch; Radiation Effects Research Foundation, Hiroshima (Japan)). Feb 1978. Contract EX-76-C-28-3161. 15p. (In Japanese and English). P 02/MF A01.

The prevalence of roentgenologically-detected foregin bodies among atomic bomb survivors was studied as an indicator of the A-bomb blast effects. Acupuncture was studied as an indicator of possible A-bomb-related abnormalities for which it was administered. All available roentgenograms of Adult Health Study (AHS) subjects which demonstrated foreign bodies were reviewed. The frequency of glass and metal foreign bodies and of acupuncture needles was analyzed in detail. Analyses were made by distance from the hypocenter, sex, age, body sites involved, and shielding at the time of the A-bomb (ATB). The presence of glass fragments correlated closely with distance from the hypocenter, with heavy shielding from the A-bombs, and with adulthood, and they were more frequent in the chest than in the hand and wrist. On the contrary, metal foreign bodies were more frequent in the hand and wrist than in the chest, and were not associated with distance from hypocenter or heavy shielding. The prevalence of acupuncture needles increased with age, but did not correlate with A-bomb dose.

MICROBIOLOGY

REFER ALSO TO CITATION(S) 52158

PATHOLOGY

REFER ALSO TO CITATION(S) 52208, 52210, 52235

52202 (RERF-TR—6-78) **Autopsy study of cerebrovascular disease in Japanese men who lived in Hiroshima, Japan and Honolulu, Hawaii.** Mitsuyama, Y.; Thompson, L.R.; Hayashi, T.; Lee, K.K.; Keehn, R.J.; Resch, J.A.; Steer, A. (Radiation Effects Research Foundation, Hiroshima (Japan)). Jan 1979. Contract EX-76-C-28-3161. 17p. (In Japanese and English). P 02/MF A01.

Evidence of cerebrovascular disease at autopsy was compared in two groups of men, 186 long time residents of Hiroshima, Japan and 253 men of Japanese ancestry long resident in Honolulu, hawaii. They were from 45 to 71 years of age at death. Atherosclerosis of the circle of Willis and its major branches, sclerosis of the intraparenchymal arteries and the frequency of cerebral hemorrhage and cerebral infarct were compared in the two populations. The Honolulu subjects had significantly more atherosclerosis of the circle of Willis, but less intraparenchymal artery sclerosis and less cerebral infarction. Cerebral hemorrhage was equally frequent in the two cities. It was concluded that cerebral infarction is more frequent in Japanese men in Hiroshima than Honolulu, and that men of Japanese ancestry in Honolulu are spared an appreciable risk of cerebral infarction through decreased frequenncy of intraparenchymal arterial sclerosis despite higher levels of atherosclerosis of large intracranial arteries.

52203 (RERF-TR—13-78) **Relationship between epidemiological factors and mortality among atomic bomb survivors, Hiroshima and Nagasaki.** Nagai, M. (Radiation Effects Research Foundation, Nagasaki (Japan). Nagasaki Branch; Radiation Effects Research Foundation, Hiroshima (Japan)). Jan 1978. Contract EX-76-C-28-3161. 26p. (In Japanese and English). P 03/MF A01.

Information concerning a number of environmental and individual factors was obtained by a main questionnaire survey conducted in 1965 on 11,724 males aged 40-69 years in the JNIH-ABCC Life Span Study sample. In the ensuing 10 year period, some 2,834 deaths occurred in this population. This is a study of mortality as related to certain environmental and socioeconomic factors. The following observations may be made from this study: high death rates for all causes of death, cerebrovascular diseases, all malignant neoplasms, and stomach cancer were associated with lower socioeconomic status. Smoking was a significant risk factor for all causes of death, ischemic heart diseasse, all malignant neoplasms, stomach cancer, and cancers of the trachea, bronchus, and lung. The death rate for cardiovascular disease was significiantly higher for those with higher body weight. A tendency was noted for higher death rates for all causes, all malignant neoplasms, lung cancer, and stomach cancer for those who were married earlier in life. This may be related to age at first marriage and social status.

TRACER TECHNIQUES

REFER ALSO TO CITATION(S) 52217

PHYSIOLOGICAL SYSTEMS

REFER ALSO TO CITATION(S) 52196, 52240

52204 (LBL—9300) **Empirical method that provides a basis for the organization of relaxation labeling processes for vision.** Montalvo, F.S.; Weisstein, N. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; State Univ. of New York, Buffalo (USA). Dept. of Psychology). Jun 1979. Contract W-7405-ENG-48. 4p. (CONF-790824—3). P 02/MF A01.

From 6. International joint conference on artificial intelligence; Tokyo, Japan (20 Aug 1979).

Relaxation labeling is a technique used in computer vision which parallels the operation of human vision. Weisstein et al. have developed an experimental method for investigating higher-level processes while maintaining a close tie to the underlying brain structure. Here we demonstrate that because of the close correspondence between relaxation labeling processes and neural network processes, the experimental results provide a basis for the design of relaxation labeling processes for vision.

AGRICULTURE AND FOOD TECHNOLOGY

REFER ALSO TO CITATION(S) 51317, 51829, 52146, 52156

52205 (LA-UR—79-1760) **Electronic identification and remote temperature monitoring in livestock management and disease control.** Seawright, G.L.; Holm, D.M. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 7p. (CONF-790724—1). P 02/MF A01.

From 21. world veterinary congress; Moscow, USSR (1 Jul 1979).

The system described here could form the basis for an international livestock identification system with disease detection capability. Veterinarians throughout the world should start to consider how widespread use of such a system could alter their approach to food animal disease control.

TRACER TECHNIQUES

REFER ALSO TO CITATION(S) 52229

BIOMEDICAL SCIENCES, APPLIED STUDIES

IN MICROORGANISMS

REFER ALSO TO CITATION(S) 52207

IN ANIMALS

REFER ALSO TO CITATION(S) 52216, 52217

RADIATION EFFECTS ON CELLS

EXTERNAL SOURCE

52206 (BNL—26454) **Relationship of DNA lesions and their repair to chromosomal aberration production.** Bender, M.A. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 36p. (CONF-790676—4). P 03/MF A01.

From Conference on DNA repair and mutagenesis in bacteria; Atlanta, GA, USA (25 Jun 1979).

Recent work on the roles of specific kinds of DNA lesions and their enzymatic repair systems in the production of chromoso-

mal aberrations seems consistent with a simple molecular model of chromosomal aberrations formation. Evidence from experiments with the human repair-deficient genetic diseases xeroderma pigmentosom, ataxia telangiectasia, and Fanconi's anemia is reviewed in the light of the contributions to aberration production of single and double polynucleotide strand breaks, base damage, polynucleotide strand crosslinks, and pyrimidine cyclobutane dimers.

RADIATION EFFECTS ON MICROORGANISMS

BASIC STUDIES

52207 (COO—3221-56) **Radiation-induced damage in E. coli B: The effect of superoxide radicals and molecular oxygen. Progress report, December 1, 1978—November 30, 1979.** Samuni, A.; Czapski, G. (Hebrew Univ., Jerusalem (Israel)). [nd]. Contract EY-76-C-02-3221. 20p. P 02/MF A01.

The roles of superoxide radicals and of molecular oxygen in the radiodamage of E. coli B suspended in dilute phosphate buffer were studied. The presence of high concentrations of polyethylene glycol in the γ-irradiated cell suspensions, had no effect on bacterial radiosensitivity. This indicates that the damage was primarily endogenous, i.e. originated intracellularly. Saturation of the cell suspensions with N_2O doubled the radiosensitivity, thus indicating that OH radicals are responsible for the majority of the damage (indirect radiation effect). The presence of oxygen either in the absence or presence of N_2O brought about roughly a three-fold increase in the radiosensitivity. Since in the presence of N_2O all e^-/sub aq/ are scavenged by the nitrous oxide rather than by oxygen, this shows that superoxide radicals play no role in the bacterial radiodamage. Our results substantiate the attribution of the oxygen effect to a direct interaction of O_2 with the hydroxyl-radical-damaged sites on vital biomolecules, and exclude any significant contribution of e^-/sub aq/ and superoxide radicals to the cellular radiodamage.

RADIATION EFFECTS ON ANIMALS

MAN

52208 (CONF-790486—6) **Radiation toxicology.** Fry, R.J.M.; Storer, J.B.; Ullrich, R.L. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-31-109-ENG-38;W-7405-ENG-26;. 26p. P 03/MF A01.

From Biology division research conference on the scientific basis of toxicity assessment; Gatlinburg, TN, USA (15 Apr 1979).

The extensive studies on both human and experimental animal populations have provided information that allows radiation protection standards to be set with greater confidence than for most if not all other carcinogenic agents. Furthermore, both international and national advisory bodies are continually updating the risk estimates and the standards as new information is available. However, it is clear that we need models that take into account the multistage nature of carcinogenesis. Studies in both ionizing and ultraviolet radiation carcinogenesis are more valuable to the general problem of elucidating the mechanisms involved in cancer than is indicated by the amount of work or support for this field of research.

52209 (PNL—2898) **Environmental radon and radon daughter dosimetry in the respiratory tract.** McPherson, R.B. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Apr 1979. Contract EY-76-C-06-1830. 24p. P 02/MF A01.

This report describes work performed by Pacific Northwest Laboratory (PNL) for the Nuclear Regulatory Commission's program to determine safety and costs related to decommissioning nuclear fuel cycle facilities. Individual dose factors for the inhalation of radon and its daughter products are calculated for use in environmental dose assessments. The calculated committed dose equivalent factors for ^{222}Rn and its daughters are tabulated for lungs, bronchi tract and other organs. An activity median aerodynamic diameter of 0.1 μm was used. The dose to an individual is calculated by multiplying the estimated intake from inhalation for a particular radionuclide by the corresponding dose factor. A working level month-to-dose conversion factor is calculated to be 1 rad/WLM to the epithelial tissue of the T-B region, assuming 100% daughter equilibrium and 10% free ^{218}Po ions. This value is in reasonable agreement with recently reported values.

52210 (RERF-TR—3-78) **Relation of radiation to gastric carcinoma observed in autopsy cases in the life span study sample, Hiroshima and Nagasaki, 1961—74.** Yamamoto, T.; Shimizu, Y. (Radiation Effects Research Foundation, Nagasaki (Japan). Nagasaki Branch; Radiation Effects Research Foundation, Hiroshima (Japan)). Nov 1978. Contract EX-76-C-28-3161. 18p. (In Japanese and English). P 02/MF A01.

A study was made of the relation to atomic bomb radiation of 535 cases of gastric carcinoma among 4,694 deaths occurring in a fixed population of Hiroshima and Nagasaki who were autopsied between 1961 and 1974. The proportion of all autopsies with gastric carcinoma as autopsy diagnosis tended to be high in the high dose group, but it could not be concluded with the present amount of information that there is a relation between gastric carcinoma and radiation in this autopsy study. Although no specific distribution of the histological types of gastric carcinoma was noted by radiation dose, the data indicated increases in the degree of extension of tumor cells in the gastric wall and the degree of metastasis to the lymph nodes seemed to be high in the high dose group.

52211 (RERF-TR—12-77) **Relationship between dose and chromosome aberrations in atomic bomb survivors, Hiroshima and Nagasaki.** Awa, A.A.; Sofuni, T.; Honda, T.; Itoh, M.; Neriishi, S.; Otake, M. (Radiation Effects Research Foundation, Nagasaki (Japan). Nagasaki Branch; Radiation Effects Research Foundation, Hiroshima (Japan)). Jun 1978. Contract EX-76-C-28-3161. 26p. (In Japanese and English). P 03/MF A01.

Radiation-induced chromosome aberrations were found to persist in cultured peripheral blood lymphocytes derived from Hiroshima and Nagasaki A-bomb survivors long after their radiation exposure. Earlier observations that the frequency of cells with chromosome aberrations increased in proportion with increasing dose in both cities were reconfirmed. However, in every dose group, the frequency of aberrant cells was consistently higher in Hiroshima than in Nagasaki. Results suggesteed that a higher neutron dose in Hiroshima than in Nagasaki may have been a major component contributing to the difference in dose response between the two cities. Among the types of chromosome aberrations so far identified, reciprocal translocations were observed to predominate, and they played an important role in determining the dose-aberration relationship. Furthermore, it was recognized that symmetric chromosome exchanges seem to be a useful index of late radiation effects on somatic cells in vivo.

52212 (RERF-TR—13-77) **G-banding analysis of chromosome aberrations in Hiroshima atomic bomb survivors.** Sofuni, T.; Shimba, H.; Ohtaki, K.; Awa, A.A. (Radiation Effects Research Foundation, Nagasaki (Japan). Nagasaki Branch; Radiation Effects Research Foundation, Hiroshima (Japan)). Jan 1978. Contract EX-76-C-28-3161. 10p. (IN Japanese and English). P 02/MF A01.

A total of 896 metaphases obtained from 2-day culture of peripheral blood lymphocytes of 23 heavily exposed atomic bomb survivors of Hiroshima were examined first by an ordinary staining method, and then reexamined after trypsin-G-banding stain. There were 348 metaphases identified as having abnormal karyo-types by either one or both methods. Of these aberrant cells, 293 were found to have chromosome aberrations by the ordinary stain, and 6 of the 293 were identified as normal by G-banding stain, 4 of which were misjudged in the ordinary preparation due to the presence of partially distorted chromosomes. Furthermore, there were 55 metaphases in which abnormalities were detected only by G-banding, including paracentric inversions, and intra- and interchanges of chromosome segments with equal lengths.

52213 (RERF-TR—14-77) **Incidence of leukemia among atomc bomb survivors in relation to neutron and gamma dose, Hiroshmia and Nagasaki, 1950—71.** Ishimaru, T.; Otake, M.; Ichimaru, M. (Radiation Effects Research Foundation, Nagasaki (Japan). Nagasaki Branch; Radiation Effects Research Foundation, Hiroshima (Japan)). Mar 1978. Contract EX-76-C-28-3161. 16p. (In Japanese and English). P 02/MF A01.

The incidence of leukemia during 1950—71 in the fixed mortality sample of atomic bomb survivors in Hiroshima and Nagasaki has been analyzed as a function of individual gamma and neutron kerma and marrow dose. Two dose reponse models were tested for each of acute leukemia, chronic granulocytic leukemia, and all types of leukemia, respectively. Each model postulates that leukemia incidence depends upon the sum of the separate risks imposed by the gamma ray and neutron doses; in Model I both are assumed to be directly proportional to the respective doses, while Model II assumes that while the risk from neutrons is directly proportional to the dose, the risk from gamma rays is proportional to dose-squared. Weighted regression analyses were performed for each model.

52214 (RERF-TR—16-77) **Bone marrow cytology in Hiroshima atomic bomb survivors 5 years following exposure.** Oesterle, S.N.; Finch, S.C. (Radiation Effects Research Foundation, Nagasaki (Japan). Nagasaki Branch; Radiation Effects Research Foundation, Hiroshima (Japan)). Nov 1978. Contract EX-76-C-28-3161. 25p. (In Japanese and English). P 02/MF A01.

Bone marrow aspiration smears obtained from 35 individuals, 5 years following expsoure to the Hiroshima atomic bomb, were intensively evaluated for radiation related cytologic abnormalities. No definite radiaton related changes were observed, but some findings were very suggestive. The most interesting of these was the occurrence of internuclear bridges joining erythroid precursors in the marrow smears of seven (20%) of the heavily exposed survivors.

Although not specific it is likely that this lesion is indicative of residual stem cell damage and some degree of ineffectual erythropoiesis. The bone marrow morphologic lesions may be good markers of residual radiation damage but they are too infrequent in their occurrence to be of value as a biologic dosimeter. The findings in this study also suggest that a gradual disappearance of radiation induced late bone marrow changes continues for periods of 3 to 5 years or more following high dose acute radiation exposure.

52215 Considerations in the assessment of plutonium deposition in man. Voelz, G.; Umbarger, J.; McInroy, J.; Healy, J. (Los Alamos Scientific Lab., NM (USA)). pp 163-175 of Diagnosis and treatment of incorporated radionuclides. Vienna; IAEA (1976).

From IAEA international seminar on diagnosis and treatment of incorporated radionuclides; Vienna, Austria (8 Dec 1975).

Data from human cases of plutonium inhalation are used to illustrate several important problems in the current methods of estimating plutonium body burdens. Individuals exposed to $^{238}PuO_2$ particles in a highly insoluble matrix showed an unusually slow rising urinary excretion curve over 300 - 400 days. In-vivo chest counts during the first 6 months estimated lung burdens to be 10 - 30 nCi, but urinary excretion methods calculate residual systemic body burdens of 50 - 100 nCi at 1200 days after exposure. Current assumptions used in the in-vivo calibration do not consider possible lung distribution of particulates soon after exposure that could alter the interpretation significantly. Tissue analysis of a lung from another case after recent inhalation exposure shows a significantly lesser concentration of plutonium in the subpleural region - the principal region of plutonium measurement by in-vivo chest counting - as compared to distributions found years after exposure. Tissue analyses indicate that urinary excretion estimates of body burden over the long term tend to err on the high side up to a factor of 5 or more. This procedure serves well for the purpose of protection of workers, but high estimates can lead to unnecessary job reassignments for the individual worker and can cause misleading conclusions when such data are used uncritically for reference in health effects studies. Additional research is needed to improve urinary excretion data analysis to reflect newer information derived from tissue data and to seek further understanding of the sources of variation in in-vivo counting technology so it can be used with greater confidence.

VERTEBRATES

52216 (CONF-790676—5) **Radiation- and drug-induced DNA repair in mammalian oocytes and embryos.** Pedersen, R.A.; Brandriff, B. (California Univ., San Francisco (USA)). 1979. Contract EY-76-C-03-1012. 39p. P 03/MF A01.

From Conference on DNA repair and mutagenesis in bacteria; Atlanta, GA, USA (25 Jun 1979).

A review of studies showing ultraviolet- or drug-induced unscheduled DNA synthesis in mammalian oocytes and embryos suggests that the female gamete has an excision repair capacity from the earliest stages of oocyte growth. The oocyte's demonstrable excision repair capacity decreases at the time of meiotic maturation for unknown reasons, but the fully mature oocyte maintans a repair capacity, in contrast to the mature sperm, and contributes this to the zygote. Early embryo cells maintain relatively constant levels of excision repair until late fetal stages, when they lose their capacity for excision repair. These apparent changes in excision repair capacity do not have a simple relationship to known differences in radiation sensitivity of germ cells and embryos.

52217 (COO—3380-T1) **Tumorigenic action of beta, proton, alpha and electron radiation on the rat skin. Progress report, August 1, 1977—January 31, 1979.** Burns, F.J.; Albert, R.E. (New York Univ., NY (USA). Dept. of Environmental Medicine). 1979. Contract EY-76-S-02-3380. 20p. P 02/MF A01.

Epithelial tumors are induced reproducibly in rat skin exposed to ionizing radiation, ultraviolet light, or polycyclic aromatic hydrocarbons. For these carcinogens, the comparative risk of tumor formation is being examined for clues to the generality of action and the mode of interaction of diverse carcinogens. Molecular lesions, such as, pyrimidine dimers and single-strand breaks in DNA have been measured as a basis for assessment of cellular dose. Dose-response for single doses, time-response for multiple doses, and repair or recovery of oncogenic damage are major areas of current interest.

52218 (ORO—4568-20) **Repair and cell cycle response in cells exposed to environmental biohazards. Progress report, October 1, 1976—May 31, 1979.** Billen, D. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)). 1979. Contract EY-76-S-05-4568. 16p. P 02/MF A01.

A wide variety of environmental agents are known which induce damage in DNA leading to an inhibition of DNA synthesis or faulty replication. Both results may cause cell death or mutation. Both bacteria and mommalian cells are being used to assess the roles of the several known DNA polymerases and other DNA metabolic enzymes and factors in DNA repair, replication and recombination. The many DNA mutants of E. coli and B. subtilis provide a genetic approach to measuring the role of individual components of the DNA repair and replicative system. Because of the advantage of controlling pools and precursors of nucleic acid synthesis we have further developed the use of permeabilized cells for such studies. In addition a series of repair studies with Bacillus subtilis have been carried on because of the unique genetic manipulation of this system which includes the ability of celis to be easily transformed by exogenous DNA. The information obtained with prokaryotes provides leads to assess the details of DNA repair and replication in mammalian systems including man.

MAN

REFER ALSO TO CITATION(S) 52219

NUCLIDE KINETICS AND TOXICOLOGY

REFER ALSO TO CITATION(S) 52187

MAN

REFER ALSO TO CITATION(S) 51423, 52152, 52187, 52209

52219 (ORNL/TM—6571) **INGDOS: a conversational computer code to implement US Nuclear Regulatory Commission Regulatory Guide 1.109 models for estimation of annual doses from ingestion of atmospherically released radionuclides in foods.** Pleasant, J.C. (Oak Ridge National Lab., TN (USA)). Aug 1979. Contract W-7405-ENG-26. 68p. P 04/MF A01.

INGDOS is a conversational FORTRAN IV program which utilizes models described in U.S. Nuclear Regulatory Commission Regulatory Guide 1.109 for calculating: (1) concentrations of airborne radionuclides in foods; and (2) annual doses to various organs of man from ingestion of foods contaminated by radionuclides released to the atmosphere. An exception to the implementation of models described in the Regulatory Guide is the adoption of other previously described models for estimation of doses for ^{3}H and ^{14}C. An on-line data base provides default values for most of the parameters required in the calculation of these quantities. In most cases the program allows the user to change any of these values for a particular run. With the exception of ^{3}H and ^{14}C, the calculation of nuclide concentrations in and on vegetation at a given location is based on the rate of deposition of the nuclide at the given location, which is the product of the ground-level air concentration and the deposition velocity of the nuclide. The last two quantities must be supplied by the user of the code for each nuclide other than ^{3}H or ^{14}C involved in the run. As output from INGDOS, the user may have any (or all) of 11 tables printed which specify nuclide concentrations and annual organ doses via various pathways as well as certain ratios involving these quantities. The models for calculating nuclide concentrations and organ doses are discussed, and information is provided concerning the use of the code and its data base.

ANIMALS

REFER ALSO TO CITATION(S) 52063, 52152, 52154, 52229

PLANTS

REFER ALSO TO CITATION(S) 52219

THERMAL EFFECTS

MICROORGANISMS

52220 (COO—2532-4) **Effects of environmental stresses on the species composition of phytoplankton populations. Progress report, May 1, 1978—February 28, 1979.** Ryther, J.H.; Sanders, J.G. (Woods Hole Oceanographic Institution, MA (USA)). Feb 1979. Contract EY-76-S-02-2532. 199p. P 09/MF A01.

Unfiltered Vineyard Sound seawater circulated through 1000-liter fiberglass tanks at 10% volume exchange per day maintains a reasonably constant phytoplankton community that is also representative of the natural assemblage. Sixteen such tanks have been stresed with addition of free chlorine and copper, and temperature increase, in all possible combinations and at increments of 0.05 ppM Cl^{-}, 5.0 $\mu g/l$ Cu^{++}, and 2°C temperature increase in experiments of 4 to 6 weeks duration. At the lowest stress level, the tank culture exposed to chlorine after 19 days had a decreased total population size, lower diversity, a similarity index significantly different from the control, and a community dominated by Skeletonema costatum, which was absent from the control culture. The copper-exposed

culture showed similar but smaller effects. Chlorine and copper together cancelled each others effects. No effect was seen from a temperature increase of 2°C alone or together with other stresses. The experiment at the next highest stress level was complicated by sub-zero temperatures and freezing input lines. The greatest effect was caused by temperature increase (+4°C) which caused a shift from diatoms to a variety of flagellates. Diatoms, particularly S. costatum and Chaetoceros spp., remained dominant in the C^{-} and Cu^{++} stressed culture not exposed to thermal increase.

VERTEBRATES

REFER ALSO TO CITATION(S) 52205

CHEMICALS METABOLISM AND TOXICITY

52221 (BNL—50932) **Aquatics task force on environmental assessment of the Atikokn Power Plant: effects on aquatic organisms.** Hendrey, G.R. (Brookhaven National Lab., Upton, NY (USA)). Nov 1978. Contract EY-76-C-02-0016. 19p. P 02/MF A01.

Possible impacts of an 800-MW coal-fired power plant to be built near Atikokan, Ontario were evaluated. It is feared that the emissions of SO_2 will lead to the deposition of sulfuric acid and result in the acidification of freshwaters in nearby parks and wilderness areas. The most obvious biological effects of acidification are damages to populations of fish. Less conspicuous but no less severe damages also occur to other organisms. It appears that all trophic levels are affected: species numbers are reduced, biomasses are altered, and primary production and decomposition are impaired. Field experiments and laboratory experiments indicate that microbial activity is reduced and that the recycling of materials is greatly impeded at low pH. This may interfere with nutrient supplies to plants and decrease the microbial biomass available to higher trophic levels. Phytoplankton densities decrease in acidified lakes and there is a reduction in some species of macrophytes. On the other hand, Sphagnum and benthic filamentous algae greatly increase in acidified conditions. The total primary productivity of lakes and streams may actually increase because of such dense growths on the bottom. Zooplankton and benthic invertebrate communities become less complex as acidity increases. This may in part be due to reduced food supplies, but direct inhibition by H_2SO_4 has also been demonstrated. This removal of fish food organisms may exacerbate damage to fisheries, especially in the pH range of 5 to 6. When a lake loses all fish because of low pH, a few species of invertebrates may become very abundant. The salamanders Ambystoma jeffersonium and A. maculatum, sensitive to acidity below pH 7.0 and 5.0 respectively, are being eliminated from small ponds or temporary pools in the region around Ithaca, NY because of the impact of acid precipitation. Species of frogs in some lakes are also being eliminated because of acidification. (ERB)

52222 (COO—2718T015-1) **Geochemistry and the environment. Volume III. Distribution of trace elements related to the occurrence of certain cancers, cardiovascular diseases, and urolithiasis.** (National Academy of Sciences - National Research Council, Washington, DC (USA)). 1978. Contract EY-76-C-02-2708-015. 210p. P 10/MF A01.

Volume III of the three-volume series is based on a 1974 workshop and some updated material. It considers the sources and pathways by which trace elements get to man through the food chain from rocks, water, and soils to plants and food. From there, it considers three disease groups that may be both causally implicated and significantly distributed geographically. The three disease areas are esophageal, stomach, and colorectal cancer; cardiovascular disease including hypertension and stroke; and urolithiasis, or more particularly kidney stones, rather than bladder stones. The text of the volume closes with brief assessments of how innovations in geography, cartography, remote sensing, and data-information systems may be brought to bear on such broad and difficult problems. The appendices contain information or examples of major data sources and concepts.

52223 (NP—23880) **Study of the influence of cooling water additives on surface waters.** Wunderlich, M. (Bundesanstalt fuer Gewaesserkunde, Koblenz (Germany, F.R.)). Feb 1978. 61p. (In German). U 04/MF A01.

The study is intended to give a survey of the present state of the applications of chemicals in cooling processes. The influence of these agents on surface waters increases with the increasing use of circulation cooling. Basis of the study is a literature survey and an elaboration by two professional organizations, which had been suggested by the Federal Institute of Hydrology. On this basis, model computations were carried out in the form of limiting-value determinations for a single power station with circulation cooling, involving the most important cooling water treatment agents. The study shows that at present and in the foreseeable future, cooling water agents are not of global significance. Regionally, however, low discharge streams may be influenced by the chemical additives. Recommendations to producers, distributors and users of cooling water chemicals are given. Questions still open are indicated.

CELLS

REFER ALSO TO CITATION(S) 52198, 52216

MICROORGANISMS

REFER ALSO TO CITATION(S) 52158, 52220

52224 (CONF-790676—1) **Relationship between repair processes and mutation induction in bacteria.** Kimball, R.F. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 44p. P 03/MF A01.

From Conference on DNA repair and mutagenesis in bacteria; Atlanta, GA, USA (25 Jun 1979).

The main repair and replication-associated processes that can influence the induction of mutations by various mutagens in bacteria are reviewed. These include both constitutive and induced, error-free and error-prone systems. The mutation yield from a treatment with a mutagen can be markedly affected by which of these systems is operating in a given bacterial species or strain. The effect of these systems on mutation induction by ultraviolet light, monofunctional alkylating agents, base analogues, and frameshift mutagens is discussed in some detail. The bearing of these studies on the practical problems of estimating hazards is briefly considered. 79 references.

PLANTS

52225 (COO—1599-153(Pt.1)) **Dissolved organic matter and lake metabolism. Technical progress report, 1 July 1978—30 Jun 1979.** Wenzel, R.G. (Michigan State Univ., Hickory Corners (USA). W.K. Kellogg Biological Station). 1979. Contract EY-76-S-02-1599. 68p. P 04/MF A01.

Progress is reported in continuing investigations focused on integrated studies of the qualitative and quantitative cycling and metabolism of particulate and dissolved organic carbon in lakes and their inflow sources (surface and subsurface). Emphasis is placed on the sources, fates, and interactions of dissolved and particulate organic matter in relation to: (a) inorganic chemical cycling, (b) allochthonous loading to the lake system, and (c) the coupled nutrient physiology and metabolism of phytoplankton, bacterial populations, macrophytes, and attendant sessile algal-bacterial communities. Regulatory mechanisms of growth and rates of carbon and nutrient cycling are being evaluated among the (a) inorganic-organic influxes of allochthonous sources as they are controlled by wetland-littoral communities, (b) the littoral photosynthetic producer-decomposer complex, and (c) the microflora of the pelagial zone. Quantification of carbon fluxes among these components and control mechanisms is fundamental to elucidation of the rate functions of lake eutrophication. The integrated studies addressing these multifacted objectives are summarized in three summary diagrams.

52226 (COO—4331-2) **Air pollution effects on food quality. 2nd annual progress report.** Pell, E.J. (Pennsylvania State Univ., University Park (USA). Center for Air Environment Studies). Feb 1979. Contract EE-77-S-02-4331. 14p. (CAES—525-79). P 02/MF A01.

Progress is reported in studies to determine the effect of acute, toxic exposures of ozone to alfalfa, potato, and soybean plants. The objective has been to correlate the foliar response with alterations in quality of the edible portion of the plant viz. the leaf, tuber and seed of alfalfa, potato and soybean, respectively. In 1977 we (1) modified our fumigation facilities, (2) developed protocol for studies with alfalfa and potato, and (3) conducted studies on flavonoid status of alfalfa and a series of parameters of potato tubers. In 1978 we (1) conducted more indepth studies with alfalfa, (2) repeated the potato study, (3) began to develop protocol for measuring additional parameters of alfalfa and potato quality, and (4) developed protocol for cultivating and exposing soybean plants.

52227 (IMMR—32-M4-77, pp 65-67) **Sintered coal refuse as a growing medium for plants.** Buxton, J.W.; Knavel, D.E.; Yost, G. (Univ. of Kentucky, Lexington). Dec 1977.

From 3. coal refuse disposal and utilization seminar; Lexington, KY, USA (11 May 1977).

The sintered coal refuse used in this study may be used as a growing medium for container-grown plants. Plants produced in various combinations of sintered coal refuse and peat were equal in quality to those produced in standard media. Media consisting of sintered coal refuse provided sufficient aeration for root growth, did not compact, and were stable. Above all, the sintered coal did not release chemicals toxic to plants. Whether sintered coal refuse will in the future be used as a constitutient of containerized media, will depend on further studies to determine if sintered coal produced from other refuse piles has characteristics similar to that used in this study. The use will also be determined by the availability of sintered

coal to growers and, probably most important, how will the price compare with that of other materials available.

INVERTEBRATES

52228 (CONF-790486—1) **Interaction of platinum compounds with the genome: correlation between DNA binding and biological effects.** Rahn, R.O.; Johnson, N.P.; Hsie, A.W.; Lemontt, J.F.; Masker, W.E.; Regan, J.D.; Dunn, W.C. Jr.; Hoeschele, J.D.; Brown, D.H. (Oak Ridge National Lab., TN (USA); Oak Ridge Associated Universities, Inc., TN (USA)). 1979. Contract W-7405-ENG-26. 11p. P 02/MF A01.

From Biology division research conference on the scientific basis of toxicity assessment; Gatlinburg, TN, USA (15 Apr 1979).

Evidence has been presented as to how cis-Pt binds to DNA and causes mutations and cell killing. Inhibition of DNA synthesis is thought to be the major reason why cells treated with cis-Pt die. Because cis-Pt binds to DNA in rat cells up to 10-fold more effectively than trans-Pt and since the cis isomer inhibits DNA synthesis 5-fold more effectively than the trans isomer, then from a simplistic point of view it is relatively easy to see how the cis isomer might be more toxic to an animal cell than the trans isomer. Furthermore, if inhibition of DNA synthesis initiates cell killing, then fast-growing tumor cells are more likely to be affected by Pt than normal nondividing cells.

52229 (NUREG/CR—0747) **Effects on oysters of increased levels of copper in seawater.** Harrison, F.L.; Rice, D.W. Jr. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 Jun 1978. Contract W-7405-ENG-48. 52p. (UCRL—52509). P 04/MF A01.

Sensitivity of the Pacific oyster, Crassostrea gigas, to copper was evaluated in experiments of 2-wk duration. Groups of 8 to 10 animals were exposed to copper concentrations ranging from 100 to 1300 μg/l in a high-volume, flow-through bioassay system. The greatest mortality at 96 h occurred in animals at intermediate rather than high copper concentrations. However, by correcting the duration of exposure of each oyster to copper by a factor related to the amount of time the shells were open, we obtained typical mortality curves. Significant mortalities occurred at copper concentrations ≧ 200 μg/l. Distribution of ^{64}Cu in oysters after 24-h exposure differed between animals maintained in water containing high and low concentrations of copper. Copper flux into tissues increased with the copper concentrations in the water, indicating little metabolic regulation.

52230 (NUREG/CR—0835) **Toxicity and effects of bromoform on five marine species.** Gibson, C.I.; Tone, F.C.; Wilkinson, P.; Blaylock, J.W. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1979. Contract EY-76-C-06-1830. 15p. (PNL—3023). P 02/MF A01.

Bromoform has been identified as the single most abundant halogenated organic compound produced by the chlorination of marine waters. To determine the potential biological effects of its release into marine waters, short-term toxicity bioassays and 28-day uptake/28-day depuration studies were conducted with five marine species: Protothaca staminea, Mercenaria mercenaria, Crassostrea virginica, Penaeus aztecus, and Brevoortia tyrannus. The bioassay studies indicate that 96-hr LC_{50}'s ranged from approximately 7 ppM for B. tyrannus to greater than 40 ppM for P. staminea. The behavior of P. aztecus and B. tyrannus was significantly altered by exposure to bromoform.

VERTEBRATES

REFER ALSO TO CITATION(S) 52216, 52230

52231 (CONF-790537—2) **CHO/HGPRT mutation assay. IV. Progress with quantitative mutagenesis and mutagen screening.** Hsie, A.W.; O'Neill, J.P.; San Sebastian, J.R.; Brimer, P.A. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Oak Ridge (USA). Graduate School of Biomedical Sciences). 1979. Contract W-7405-ENG-26. 25p. P 02/MF A01.

From Cold Spring Harbor symposium on quantitative mammalian cell mutagenesis and mutagen screening; Cold Springs Harbor, NY, USA (6 May 1979).

Work is summarized on development and application of their mutation system to study mutagenicity of various physical and chemical agents which bear profound environmental concerns. Eleven alkylating chemicals, nineteen heterocyclic nitrogen mustards, nineteen metallic compounds, nineteen miscellaneous compounds were reviewed for mutagencity. Some results remain to be confirmed. Mutagencity of various classes of promutagens were also discussed; including 27 polycyclic aromatic hydrocarbons, 16 nitrosamines, 5 quinoline compounds; 5 aromatic amines and 4 miscellaneous promutagens. (PCS)

52232 (COO—4384-T1) **Comparative evaluation of effects of ozonated and chlorinated thermal discharges on estuarine and fresh water organisms. First quarterly progress report, April 1979.** Guerra, C.R.; DelMonaco, J.L.; Singletary, J.H.; Sugam, R.J.; Meldrim, J.W.; Holmstrom, E.R.; Balog, G.F. (Public Service Electric and Gas Co., Newark, NJ (USA); Ichthyological Associates, Inc., Ithaca, NY (USA)). 1979. Contract EE-77-C-02-4384. 79p. 05.

The biological evaluation program incorporates three types of experimental tests: acute (96 hour) toxicity studies; behavioral (avoidance) response studies; and physiological (cough) response studies. In addition, specimens used in testing are examined for physical damage resulting from exposure to chlorine or ozoen. The objective of the acute (96 hour) toxicity study is to determine the respective lethal levels (LC_{50}) of chlorinated and ozonated waters. The objective of the behavioral (avoidance) response study is to determine what (if any) concentrations of ozone and of chlorine will be avoided. The objective of physiological (cough) response study is to determine what concentrations of ozone and of chlorine are physiologically detected. Ozonated and chlorinated waters were evaluated in all studies for both the addition of increased temperature and without it. Results indicate that ozone is less toxic than chlorine under the test conditions used. The lethal levels vary according to species of water quality measurements at Bergen Generating Station, New York are tabulated. (JBG)

52233 (LA-UR—79-1955) **Flow cytometric methods for assaying damage to respiratory tract cells.** Steinkamp, J.A.; Wilson, J.S. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 12p. (CONF-790334—12). P 02/MF A01.

From Oil shale symposium; Denver, CO, USA (26 Mar 1979).

This paper summarizes results of experiments designed to develop automated flow-analysis assay methods for discerning damage to exfoliated respiratory tract cells in model test animals exposed by inhalation to physical and chemical agents associated with the production of synthetic fuels from oil shale, the specific goal being the determination of atypical changes in exposed lung macrophages and epithelial cells. Animals were exposed to oil shale particulates (raw and spent), silica, and ozone, and respiratory tract cells were obtained by lavaging the lungs with normal saline. Cell samples were stained with fluorescent dyes specific for different biochemical parameters and analyzed as they flowed through a chamber intersecting a laser beam(s) of exciting light where sensors measured fluorescence and light scatter (cell size) on a cell-by-cell basis. Cellular parameters proportional to optical signals were displayed as frequency distribution histograms. Cells also were separated according to cytological features and identified. The basic features of the methodology are presented, along with examples of results that illustrate characterization and analysis of normal and exposed respiratory tract cells based on DNA content, total protein, size, and phagocytic activity.

52234 (ORNL/EIS—131) **Reviews of the environmental effects of pollutants. XIII. Endrin.** Donoso, J.; Dorigan, J.; Fuller, B.; Gordon, J.; Kornreich, M.; Saari, S.; Thomas, L.; Walker, P. (Mitre Corp., McLean, VA (USA)). Aug 1979. Contract W-7405-ENG-26. 374p. (EPA—600/1-79-005). P 16/MF A01.

A comprehensive, multidisciplinary review of the health and environmental effects of endrin (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo,endo-5,8-dimethanonapthalene) is presented. More than 600 references are cited. Endrin is used chiefly as an insecticide, particularly for the control of lepidopterous larvae that infest cotton crops. In 1971, total US consumption of endrin exceeded 600,000 kg. Endrin is highly toxic to mammals, birds, fish, and insects, but is generally nontoxic to plants. Acute exposure of mammals to endrin typically results in central nervous disorders, with convulsions leading to death through respiratory failure within two days. Symptoms of acute endrin exposure in humans include convulsions, vomiting, abdominal pain, nausea, dizziness, and headaches. Chronic exposure of mammals to endrin may result in damage to the liver, kidney, heart, brain, lung, adrenal gland, and spleen. Behavioral abnormalities, reproductive disorders, changes in carbohydrate metabolism, changes in blood composition, and other effects secondary to central nervous system disorders have also been observed following chronic exposure of mammals to sublethal doses of endrin. No malignancies attributable to endrin have been reported, but chromosomal abnormalities and teratogenesis have been induced in several mammalian species by endrin. Endrin is dissipated from the environment by photochemical and thermal decomposition and by microbial degradation. Relatively few bacteria can degrade endrin, but many species of algae and fungi exhibit this ability. Environmental contamination by endrin appears to be restricted to areas where the compound is used intensively; background concentrations in the atmosphere, hydrosphere, and lithosphere at locations distant from areas of heavy use are generally below the levels of detection.

52235 (PB—288363) **Interactions of various pollutants on causation of pulmonary disease.** Ehrlich, R. (IIT Research Inst., Chicago,

IL (USA)). Aug 1978. Contract EPA-68-02-2274. 63p. Y A04/MF A01.

Studies were conducted to determine the effects of single and multiple exposures to individual pollutants and pollutant mixtures on resistance to respiratory infections. Results of NO2 studies indicate the greater importance of short-term peak concentrations than prolonged exposures to lower concentrations in increasing the susceptibility to infections. Single 3-hr exposure to mixtures containing various concentrations of NO2 and O3 had an additive effect. Repeated 3-hr exposures for 4 weeks to mixtures consisting of 3760 micrograms/cu m NO2 and 98 micrograms/cu m O3 suggested a synergistic interaction between the two pollutants. Daily 3-hr exposures for 6 months to mixtures of 940 micrograms/cu m NO2 and 196 micrograms/cu m O3 resulted in significant excess mortality, and reduced mean survival time in infected animals. Continuation of exposure to the pollutants for 14 days after the infectious challenge resulted in a pronounced increased susceptibility to the respiratory infection, after 1, 2 or 3 month exposure. In non-infected mice this exposure regimen induced changes in the activity of several serum enzymes.

MAN

REFER ALSO TO CITATION(S) 52140

52236 (CONF-790569—1) **Toxic materials control program at ORNL revisited.** Ketchen, E.; Porter, W. (Oak Ridge National Lab., TN (USA)). May 1979. Contract W-7405-ENG-26. 16p. P 02/MF A01.

From American Industrial Hygiene Association conference; Chicago, IL, USA (27 May 1979).

Although the 70 to 75% rate for toxic materials control cards (TMCC) could certainly be better, the program has been a success. Before its inception, there was no mechanism for timely identification of chemical users throughout the laboratory. Systematic notification (via stores purchase records) could be delayed by as much as a month. More than two-thirds of the TMCCs are now received by Industrial Hygiene before materials are used. The number and variety of breathing zone samples collected continues to increase. The prompt return of TMCCs to the Industrial Hygiene before materials are used. The number and variety of breathing zone samples collected continues to increase. The prompt return of TMCCs to the Industrial Hygiene Department has allowed contact with the user and has resulted in safe use of the material or in substitution of a less toxic material.

52237 (COO—2874-4) **Evaluation of research strategies for investigation of health effects of air pollution.** Goldstein, I.F.; Goldstein, M. (Columbia Univ., New York (USA). Dept. of Mathematical Statistics). Mar 1978. Contract EY-76-S-02-2874. 22p. (CONF-7803105—1). P 02/MF A01.

From Symposium of the New York Academy of Medicine; New York, NY, USA (23 Mar 1978).

The use of linear regression as a tool in epidemiological studies to relate health indices to pollution levels is criticized. Specifically, conclusions reached in an evaluation of SO_2 pollution in New York City, and its use as an indicator of air quality are criticized. Criticisms are classified into three categories: problems with the specification of the pollution variables; problems with meteorological variables, which affect health variables directly and also interact in a complicated way with the pollution variables; and problems with the health indices, the dependent variables in these studies. (JGB)

OTHER ENVIRONMENTAL POLLUTANT EFFECTS

REFER ALSO TO CITATION(S) 52224

52238 (BNL—26222) **Photoenzyme probes of photodamage to cells and cellular DNA.** Sutherland, B.M. (Brookhaven National Lab., Upton, NY (USA)). 1979. Contract EY-76-C-02-0016. 19p. (CONF-790584—1). P 02/MF A01.

From Applications of photochemistry in probing biological targets conference; New York, NY, USA (30 May 1979).

Development of photoenzyme probes for detection of ultraviolet damage to cells and DNA is reviewed with special emphasis on a process using polyethylene glycol to induce cell fusion. Polyethylene glycol is easy to obtain and handle, is gentle to the cells and does not induce latent or productive virus infection; therefore, it may be a general method for insertion of exogenous enzymes into mammalian cells. (PCS)

52239 (SWRI—13-5277) **Preliminary study of the behavioral and biological effects of high-intensity 60-Hz electric fields. Quarterly technical progress report No. 3.** Feldstone, C.S. (Southwest Research Inst., San Antonio, TX (USA)). Feb 1979. Contract ET-78-C-01-2875. 42p. P 03/MF A01.

This preliminary study develops and thoroughly tests the experimental protocols and apparatus that are planned for a major study of the behavioral and biological effects of high-intensity 60-Hz electric fields. The behavior of baboons will be observed before, during, and after exposure to the field at maximum intensity of 60 kV/m. Both individual performance (operant conditioning) and social behavior will be examined. The present report covers Week 25 through Week 36 of the project. Construction of the facility was nearly completed, the preliminary training of the individual behavior animals was brought close to completion, and the two sets of social animals were allowed to adapt to each other and to their environment. The report addresses the following major areas: the high-voltage exposure facility; the electric-field-probe accuracy; the holding cages for social-behavior subjects; the preliminary shaping facility; the shaping procedures; and the social-behavior subjects.

52240 (UCRL-Trans—1571) **Changes in the cardiovascular system of rabbits subjected continuously to a static magnetic field of 600 Oe.** Nagakawa, M. Translated from *Sangyo Igaku;* **20**: No. 2, 112-113(1978). 8p. P 02/MF A01.

Cardiovascular changes were investigated in domestic white rabbits (3 to 3.5 kg) following a 5-wk exposure to a static magnetic field of 600 Oe. The animals were exposed in a room at 24 +- 1°C, 60 +- 5% relative humidity that was lit from 0600 to 1800 hr. The 6 experimental and 4 control rabbits were injected intramuscularly with 1 mg/kg Reserpine 24 hr prior to measurement of magnetic field effects to suppress reaction to external stimuli. Rabbits exposed to the magnetic field for a comparatively long period had an increased heart rate and peripheral blood volume compared with controls. The increase in blood volume is thought to be due to excitation of heart function and not vasodilation.

GEOSCIENCES

52241 (DOE/ER—0030) **Summaries of physical research in the geosciences.** (Department of Energy, Washington, DC (USA). Office of Basic Energy Sciences). Aug 1979. 63p. P 04/MF A01.

The Department of Energy supports research in the geosciences in order to provide a sound basis of fundamental knowledge in those areas of the earth, atmospheric, and solar/terrestrial sciences which relate to DOE's many missions. The summaries in this document, prepared by the investigators, describe the work performed during 1978, include the scope of the work to be performed in 1979 and provide information regarding some of the research planned for 1980. The following is an outline of the research areas included: geology, geophysics, and earch dynamics (large-scale earth movements; evolution of geologic structures; properties of earth materials; rock flow, fracture, and failure; continental drilling for scientific purposes); geochemistry (geothermal fluids; static rock—water interactions; organic geochemistry; geochemical migration); energy resource recognition, evaluation, and utilization (resource definition and utilization; reservoir dynamics and modeling; magma energy resources; information compilation, evaluation, and dissemination); hydrologic and marine sciences (ground water hydrology; fresh water systems; oceanography); and solar—terrestrial/atmospheric interactions (magnetospheric physics and chemistry; upper atmosphere chemistry and physics; solar radiation; meteorology and climatology). (RWR)

GEOLOGY AND HYDROLOGY

REFER ALSO TO CITATION(S) 51170, 52247

GEOPHYSICS

SEISMOLOGY AND TECTONICS

REFER ALSO TO CITATION(S) 52133, 52247

52242 (DP-MS—78-95) **In situ stress field in the southeastern United States and its implication.** Stephenson, D.E.; Pratt, H.R. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1979. Contract EY-76-C-09-0001. 22p. (CONF-790497—2). P 02/MF A01.

From 27. annual meeting of the southeastern section of the Geological Society of America; Blacksburg, VA, USA (26 Apr 1979).

Published and unpublished in situ stress measurements and studies of earthquake focal mechanisms in the southeastern United States are reviewed. These data, which provide information on the

relative magnitude and orientation of existing stress fields, are analyzed in relation to the geologic characteristics of the Southeast and are compared with data for other areas in the United States. The relation of the stress fields to observed geology and present-day tectonic processes is reviewed. Stress measurements reveal the existence of high horizontal stresses in the Appalachian complex. Different in situ stress states in the Appalachian complex, the Coastal Plain, and the stable interior region indicate different faulting mechanisms. Various techniques for determining in situ stress are consistent. 6 figures, 1 table.

52243 (JAB—00099-124) **Santa Barbara earthquake of August 13, 1978: field data report.** Philbrick, R.A.; Owen, G.N. (URS/John A. Blume and Associates, Engineers, San Francisco, CA (USA)). Aug 1979. Contract EY-76-C-08-0099. 100p. P 05/MF A01.

On August 31 and September 1, 1978, a field study was conducted of the damage inflicted on structures in the Greater Santa Barbara area by a magnitude-5.1 earthquake that occurred there on August 13, 1978. The study was undertaken to determine the general nature and extent of damage to all types of structures. Particular attention was given to the damage sustained by mobile homes because the damage to these structures during the earthquake was more extensive than expected. Other structures included in the field study were the University of California, Santa Barbara, buildings, Santa Barbara County government buildings, and private buildings. The results of this field study combined with the results of other, similar studies can be used to determine relationships between ground motion and damage. The data collected will be useful to earthquake engineers working to improve analytical procedures for predicting damage inflicted on structures by ground motion. 84 figures, 3 tables.

GEOPHYSICAL SURVEY METHODS

52244 (BMFT-FB-T—79-22) **Development of a three-dimensional seismic data acquisition and processing system.** Sattlegger, J. (Preussag A.G. Erdoel und Erdgas, Hannover (Germany, F.R.); Sattlegger Ingenieurbuero fuer Angewandte Geophysik, Meppen (Germany, F.R.)). Jun 1979. 115p. (In German). U 06/MF A01.

Three-dimensional (areal) seismic methods available on the market assume a more or less regular recording geometry. Prospecting for tectonically more and more complex targets requires the feasibility of three-dimensional seismic surveys in densely populated areas as well. A regular recording geometry may not be maintained there. It was the objective of this project to develop a three-dimensional method as flexible as possible with regard to recording geometry. All algorithms developed under this project are based upon ray theory. The system of programs obtained allows to judge irregular recording geometries by computing characteristics, preprocessing, computation of residual static corrections, interpolation of traces in the points of a regular grid and the generation of true vertical sections by migration in case of an arbitrary, irregular recording geometry. This makes it possible to perform three-dimensional seismic surveys in topographicaly difficult and/or densely populated areas. Two surveys have been carried out to date.

52245 (PB—289786) **Seismic reflection profiles of the United States east coast continental margin. Technical report.** McGregor, R.A. (National Oceanic and Atmospheric Administration, Miami, FL (USA). Atlantic Oceanographic and Meteorological Labs.). Apr 1978. 22p. Y A02/MF A01.

Five profiles of seismic reflection data from the United States east coast are described. From these profiles, two localized areas of extensive slope deposition are identified, one seaward of Albemarle Sound and the other seaward of the Delaware-Maryland-Virginia coast. The profiles show levees along the lower slope and rise portions of some of the major submarine canyons. A regional unconformity on the rise extends from Georges Bank to Wilmington Canyon and is believed to be Pliocene in age. The upper slope between Cape Hatteras and Hudson Canyon is dissected by many small valleys which are believed to have been cut during the late Pleistocene, whereas northeast of Hudson Canyon the upper slope is cut only by major submarine canyons. The Florida-Hatteras slope and Blake Plateau have many unconformities with one in late Tertiary truncating an extensive sequence of foreset beds on the north end of the Blake Plateau. The shelf width and the deposition and erosion pattern of the Florida-Hatteras slope and the adjacent Blake Plateau appear to be controlled by the Gulf Stream.

52246 (SAND—79-0868C) **Development of in situ marine seismic and geotechnical instrumentation systems.** Reece, E.W. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 18p. (CONF-790805—3). P 02/MF A01.

From DOE symposium on enhanced oil and gas recovery and improved drillings technology; Tulsa, OK, USA (22 Aug 1979).

A unique pair of in situ marine geotechnical instrumentation systems, capable of operating unattended for extended periods of time in remote locations, were designed and fabricated, and are currently undergoing testing. The Seafloor Earthquake Measurement System (SEMS) measures the response of marine sediments to strong and moderate seismic activity. The Geotechnically Instrumented Seafloor Probe (GISP) measures the in situ pore pressure in soft marine clays. The two systems have many common characteristics. Both systems consist of two principal subsystems: a seafloor data gathering package and a shipboard command and recording package. The seafloor packages are totally self-contained, and incorporate microprocessor-based electronics which control data collection, processing, and storage. Data collected and stored by the seafloor packages are transmitted on command to the command and recording package by a high-data-rate acoustic telemetry system. This paper describes the design, development, and testing of the Seafloor Earthquake Measurement System and the Geotechnically Instrumented Seafloor Probe. Data are presented and discussed. Advanced concepts for future marine geotechnical instruments are discussed. 7 figures.

52247 (SAND—79-0975) **Average structure of the upper earth mantle and crust between Albuquerque and the Nevada Test Site.** Garbin, H.D. (Sandia Labs., Albuquerque, NM (USA)). Aug 1979. Contract EY-76-C-04-0789. 25p. P 02/MF A01.

Models of Earth structures were constructed by inverting seismic data obtained from nuclear events with a 1600-m-long laser strain meter. With these models the general structure of the earth's upper mantle and crust between Albuquerque and the Nevada Test Site was determined. 3 figures, 3 tables.

MINERALOGY, PETROLOGY, AND ROCK MECHANICS

REFER ALSO TO CITATION(S) 50963

OCEANOGRAPHY

52248 **Scattering of continental shelf waves by an isolated topographic irregularity.** Chao, S.; Pietrafesa, L.J.; Janowitz, G.S. (Department of Marine Science and Engineering, North Carolina State University, Raleigh 27650). *J. Phys. Oceanogr.;* 9: No. 4, 687-695(Jul 1979).

A model for the scattering of a continental shelf wave by a small, isolated and smooth topographic irregularity is developed. It is found that a wave of frequency ω, incident on a bump of a sufficiently small horizontal extent such that the solution for a delta-function bump will apply, will trigger all other allowable modes of the same frequency with the highest modes having the largest amplitudes. Further, the higher the mode of the incoming wave, the more strongly will it be scattered. Thus, for a continuous spectrum of continental shelf waves propagating over complicated and extended topography, solely to the effects of topography. It is noted, however, that if the solution is integrated over a bump of large horizontal extent, the behavior of the forward-scattered and backscattered waves could be entirely different from that of a delta function bump.

PHYSICS RESEARCH

ASTROPHYSICS AND COSMOLOGY

REFER ALSO TO CITATION(S) 52303

SOLAR PHENOMENA

52249 (PB—289935) **Solar-geophysical data number 410, October 1978, Part I (Prompt reports). Data for September 1978, August 1978.** Coffey, H.E. (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Oct 1978. 165p. Y A08/MF A01.

This prompt report provides data for September 1978 on alert period, daily solar indices, solar flares, solar radio waves, solar x-ray radiation, coronal holes, solar wind measurements, inferred IP magnetic field polarities, mean solar magnetic field and Boulder geomagnetic substorm log. It also provides data for August 1978 on daily solar activity center, sudden ionospheric disturbances, solar x-ray radiation, solar radio waves, cosmic rays, geomagnetic indices and radio propagation indices.

52250 (PB—289936) **Solar—geophysical data number 410, October 1978, Part II. (Comprehensive reports). Data for April 1978—March 1978 and miscellanea.** Coffey, H.E. (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Oct 1978. 116p. Y A06/MF A01.

This comprehensive report for April 1978, March 1978 and Miscellaneous data provides data on active regions, synoptic solar maps, solar flares, solar radio waves, energetic solar particles and plasma, synoptic chart, abbreviated calendar record, regional flare index, solar x-ray radiation, cosmic rays, energetic solar particles and plasma for March 1978 and solar flares for February 1978.

GALAXIES

52251 (AD-A—060437) **S201 far-ultraviolet atlas of the Large Magellanic Cloud. Interim report.** Page, T.; Carruthers, G.R. (Naval Research Lab., Washington, DC (USA)). 12 Jul 1978. 153p. Y A08/MF A01.

Far-ultraviolet electrographic images, covering the wavelength ranges 1050 to 1600 A and 1230 to 1600 A, were obtained of the Large Magellanic Cloud during the Apollo 16 mission with the NRL Far-Ultraviolet Camera/Spectrograph (Experiment S201). The images have about 4-arc-minute resolution and reveal early-type star associations, individual early-type LMC stars, and galactic foreground stars. The images were analyzed in the manner described in the S201 Catalog of Far-Ultraviolet Objects (NRL Report 8173), and isodensity contour maps of the LMC were generated from the far-UV images. Individual far-UV brightnesses were determined, and corrected for interstellar extinction, for 122 Lucke-Hodge associations and 157 Henize nebulas. Over 130 other objects, of which 20 were identified as galactic foreground stars, were also measured. The ratio of UV flux to hydrogen Balmer-alpha (H-alpha) intensity, denoted hydrogen index, was determined for 90 of the Henize nebulas. The Atlas listing, which lists the individual far-UV flux measurements and hydrogen index determinations, is also available on a seven-track magnetic tape.

PLANETARY PHENOMENA

52252 **Do Jovian electrons influence the terrestrial outer radiation zone?.** Baker, D.N.; Higbie, P.R.; Belian, R.D.; Hones, E.W. Jr. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *Geophys. Res. Lett.;* **6**: No. 6, 531-534(Jun 1979).

Using energetic electron data (30 keV - 2 MeV) from instruments onboard spacecraft 1976-059A at synchronous orbit (6.6 R/sub E/), we have been able to study relatively long-term electron flux variations. Recurrently, and often with a 27-day periodicity, the daily average 0.2—2.0 MeV electron spectrum hardens dramatically. This change, wherein the power law spectral index goes from $\gamma \sim 3$—4 to $\gamma <$ or ≈ 2, occurs during quiet geomagnetic (low K/sub p/) periods usually several days after the leading edge of high-speed solar wind streams have gone past the earth. The spectral hardening is seen to be produced by a large increase in the $>$ or ≈ 1 MeV electron flux; by contrast, electrons with $E < 1$ MeV electron flux increases several days earlier than the high-energy component and this lower energy component is in close time synchronism with high solar wind speeds. Based on nearly 2.5 years of available data, it also appears that the high-energy electron flux may undergo an ~ 13-month periodicity, and for many recurrent peak intensity events we see that the flux maximum at 6.6 R/sub E/ occurs ~ 2 days after Jovian electron intensities have peaked outside the magnetosphere at IMP 7/8. Thus we suggest the possibility that Jovian electrons might contribute significantly at times to the terrestrial electron radiation belt population.

ATMOSPHERIC PHYSICS

AURORAL AND IONOSPHERIC PHENOMENA

52253 (AD-A—060612) **SOURCE: a FORTRAN-IV subroutine package that models several naturally occurring energy inputs to the mesosphere. Technical report.** Chidsey, I.L. (Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.). Aug 1978. 51p. Y A04/MF A01.

This report documents the natural energy input models used in the BENCHMARK-76 and ECLIPSE-66 studies. Energy sources included are solar x-rays, solar ultraviolet and visible light, galactic cosmic rays, and precipitated electrons. These energy sources and their interactions with the atmosphere were modeled over the range 40-100 km altitude.

EFFECTS OF NUCLEAR DETONATIONS

52254 (AD-A—060797) **Inclusion of earth reflected fields in the high altitude EMP code LHAP. Topical report, 3 January 1977—31 March 1978.** Hobbs, W.E. (Mission Research Corp., Santa Barbara, CA (USA)). May 1978. Contract DNA001-77-C-0135. 29p. Y A03/MF A01.

Fields reflected from the ground affect calculations of the high-altitude-burst EMP at times later than about 100 microseconds. A simple procedure has been developed for calculating the reflected fields and the LHAP code has been modified to include these fields in the calculation of the total EMP. With this modification the LHAP calculations are valid up to about one millisecond. (Author)

MAGNETOSPHERIC PHENOMENA

REFER ALSO TO CITATION(S) 52241, 52249

ATOMIC, MOLECULAR, AND CHEMICAL PHYSICS

REFER ALSO TO CITATION(S) 52304

52255 (UCID—18236) **Quasi-static electric field build-up between two spherical conductors.** Yee, K.S.; Kasher, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1979. Contract W-7405-ENG-48. 84p. P 05/MF A01.

It has been observed that the exposure of dielectrics to electron beams can produce electric fields of sufficient magnitude to cause dielectric break-down. It is the purpose of this investigation to calculate the electric fields for two of the geometric shapes of common interest: spherical shells and cylinders. This report summarizes the work done to date on spherical dielectric shells with an inner and outer conducting surface which are traversed by an electron beam through the sphere's center. Future work will deal with a spherical shell when the beam is displaced from the sphere's center and with cylinders.

BEAMS AND THEIR REACTIONS

REFER ALSO TO CITATION(S) 51950

52256 (AD-A—060739) **Collisional emittance growth in the particle simulation of focused beam transport. Interim report.** Haber, I. (Naval Research Lab., Washington, DC (USA)). Jul 1978. 10p. Y A02/MF A01.

By varying the number of particles used in the simulation, it is shown that numerical collisions result in a non-physical emittance growth which is proportional to the collision frequency. It is also shown that enough particles can be used so that the systems behavior is independent of their number.

52257 **Convenient method for the measurement of species composition from an intense neutral beam.** Smith, R.R.; Stearns, J.W. (University of California, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Rev. Sci. Instrum.;* **50**: No. 9, 1070-1073(Sep 1979).

We present a method to infer the approximate species mixture of neutral beam sources which accelerate positive hydrogen ions. An idealized neutral beam is specified by the accelerating voltage, the neutralizer thickness (molecules of hydrogen per cm^2), and the currents of extracted H^+, H^+_2, and H^+_3. These currents define two independent ratios which lie within a narrow parameter region and which can be determined by two independent measurements downstream from the source. The two suitable parameters are (1) the ratio of neutral beam to total beam power; and (2) the ratio of hydrogen produced by the neutral beam in the target volume to the hydrogen produced by the total beam. We give experimental results from the 10 x 10-cm^2 120-keV test stand at the Lawrence Berkeley Laboratory.

52258 **Proton affinities of hydrogen halides determined by the molecular beam photoionization method.** Tiedemann, P.W.; Anderson, S.L.; Ceyer, S.T.; Hirooka, T.; Ng, C.Y.; Mahan, B.H.; Lee, Y.T. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory, and Department of Chemistry, University of California, Berkeley, California 94720). *J. Chem. Phys.;* **71**: No. 2, 605-609(15 Jul 1979).

Gas-phase proton affinities of HF (95.5 +- 1.4 kcal/mol), HCl (135 +- 1 kcal/mol), and HBr (141 +- 1 kcal/mol) have been measured along with the HX^+—HX binding energies for the HCl and HBr systems (20 +- 2 and 23 +- 2 kcal/mol, respectively) by photoionization of van der Waals molecules produced in a supersonic expansion. A detailed discussion of the potentialities and limitations of the method is presented.

ATOMIC AND MOLECULAR PROPERTIES

REFER ALSO TO CITATION(S) 52268

52259 **Photoionization of carbon disulfide monomers and dimers in a supersonic molecular beam.** Trott, W.M.; Blais, N.C.; Walters, E.A. (Department of Chemistry, The University of New Mexico,

Albuquerque, New Mexico 87131). *J. Chem. Phys.;* **71**: No. 4, 1692-1697(15 Aug 1979).

Photoionization efficiency curves have been obtained for CS_2^+ and $(CS_2)_2^+$ using molecular beam sampling. The monomer was studied between 1005—1240 A using an optical resolution of about 1.5 A (12 meV at 1200 A). The observed ionization potential of $CS_2(^2\pi/sub\ 3/2/$ ground state) is 10.070 +- 0.006 eV. A small number of steplike fine structure features are seen in the vicinity of threshold. This structure is identified with transitions to the $^2\pi/sub\ 1/2/$ spin state (10.125 +- 0.006 eV) and a few low energy vibrational levels of the ion. These features and the intense autoionization structure exhibited by this species are discussed. The photoion yield curve of $(CS_2)_2^+$ was measured over the wavelength range 1000—1295 A at an energy resolution of about 30 meV. Ionization is first observed at approximately 9.63 eV. The onset is very weak and the photoionization efficiency rises gradually with increasing photon energy. From the measured monomer and dimer ionization thresholds, a lower limit to the dimer ion binding energy is calculated to be 11.3 kcal/mole. In comparing monomer and dimer curves, a very close correspondence of autoionization features in the region 1000—1060 A is observed. In contrast, autoionization structure which occurs in the photoion yield curve of CS_2^+ between 1100—1125 A is either markedly shifted in energy and broadly distributed or entirely absent in the $(CS_2)_2^+$ curve. These changes are interpreted in terms of the geometry of the CS_2 dimer.

52260 Partial photoionization cross sections of atomic iodine; irreducible tensor analysis of intensities. Berkowitz, J.; Goodman, G.L. (Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *J. Chem. Phys.;* **71**: No. 4, 1754-1760(15 Aug 1979).

The He I photoelectron spectrum of atomic iodine has been obtained from a thermal source. The relative intensities are compared with recent data on Cl and Br. The major difference is an inversion in the relative intensities of $^3P_0$ and $^1S_0$ between Cl and I. An intermediate coupling angular momentum treatment, combined with spectroscopic mixing parameters, reproduces this inversion quantitatively, and, in addition, adequately describes the entire intensity pattern for all three halogens. The strong implication is that angular factors and mixing parameters are the dominant features in determining relative intensities, and radial integrals and "anisotropic electron—ion interactions" are much less important.

52261 Ab initio studies of the electronic structrue of UF_6, UF_6^+, and UF^-_6 using relativistic effective core potentials. Hay, P.J.; Wadt, W.R.; Kahn, L.R.; Raffenetti, R.C.; Phillips, D.H. (Theoretical Division, University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *J. Chem. Phys.;* **71**: No. 4, 1767-1779(15 Aug 1979).

Ab initio calculations are performed on the electronic states of UF_6, UF_6^+, and UF^-_6 using a relativistic effective core potential (ECP) for uranium and a nonrelativistic ECP for fluorine. In most of the calculations 56 valence electrons are treated explicitly using a contracted [3s3p2d2f/2s2p] Gaussian basis. Various ECP's were explored, but all yield an overall charge density of U/sup +2.4/ ($F/sup -0.4/)_6$. The bonding in the ground state of UF_6 is discussed. SCF and CI calculations on UF_6^+ are compared with the experimental photoelectron spectrum and with previous scattered-wave calculations. The role of spin—orbit coupling in the states of UF_6^+ and UF_6^- is discussed. The calculated electron affinity of UF_6 (7.1 eV) is considerably larger than the current experimental estimates, but the relative energies of the states of UF_6^- are in excellent agreement (0.1—0.2 eV) with experiment.

52262 Formation of vibrationally excited diatomic molecules by stimulated radiative association: Theoretical calculations in H^+_2. Ramaker, D.E.; Peek, J.M. (Chemistry Department, George Washington University, Washington, D. C. 20052). *J. Chem. Phys.;* **71**: No. 4, 1844-1852(15 Aug 1979).

Calculations are performed to determine the degree of formation of vibrationally excited H^+_2 by stimulated radiative association. Low energy thermal collisions between the H and H^+ are assumed to take place in the presence of an intense radiation field. The parameters in the system include the temperature characterizing the thermal collisions, the width, intensity, and frequency of the stimulating radiation, and the time of flight of the colliding partners in the radiation field. The effect of each parameter on the initial production rate and the radiative equilibrium populations for each vibrational state are discussed. Possible experimental procedures are also considered. The results indicate a rather surprising degree of vibrational selectivity, particularly for the early time populations of the higher states. Relative "initial" and radiative equilibrium populations and the rate coefficients for stimulated and spontaneous emission and absorption are tabulated for individual vibrational states for a select set of calculations. Absolute populations are not tabulated but can be easily obtained from the data given.

52263 Tunable diode laser measurements of line strengths in the ν_4 band of $^{12}CH_4$. Fox, K.; Reisfeld, M.J.; McDowell, R.S. (The University of Tennessee, Department of Physics and Astronomy, Knoxville, Tennessee 37916). *J. Chem. Phys.;* **71**: No. 3, 1058-1061(1 Aug 1979).

Absolute intensities have been measured, using a diode laser spectrometer, for several vibration—rotation lines in the ν_4 fundamental of methane. The data have been analyzed, with the inclusion of Coriolis interactions, to obtain a transition moment of (0.0508 +- 0.0015) x 10^{-18} esu cm. This work appears to resolve some earlier difficulties in interpreting measurements and calculations of intensities in ν_4 of CH_4.

52264 Fragmentation of SO^+_2 prepared in state selected vibrational levels. Weiss, M.J.; Hsieh, T.; Meisels, G.G. (Department of Chemistry, University of Nebraska, Lincoln, Nebraska 68588). *J. Chem. Phys.;* **71**: No. 2, 567-570(15 Jul 1979).

The threshold photoelectron (TPE) and TPE-coincident photoion (CPI) mass spectra of SO_2 have been determined over the energy range 15.844 to 16.674 eV with a resolution of about 0.018 eV FWHM. This is sufficient to prepare most individual vibronic states in populations exceeding 85%. In the $^2B_2$ state, excitation of the stretching mode up to $\nu_1=5$ is observed, while in the same state the ν_2 bending mode may be excited concurrently with not more than one quantum. In this energy range SO^+ formation sets on at 15.930 +- 0.005 eV, suggesting that the onset at 0° K should be 15.965 eV +- 0.005 eV. S^+ is produced over a very narrow energy range only; the onset is at 16.334 eV, coincident with the (310 $^2B_2$ state of SO_2^+; S^+ disappears at 16.674 eV. This is interpreted in terms of competition between the assymetric stretch mode and the bending mode for intermodal energy transfer from the symmetric stretch mode, with excitation of the bending mode required to give S^+.

52265 Photodissociation of vibrationally excited hydrogen bromide. Zittel, P.F.; Little, D.D. (Chemistry and Physics Laboratory, The Ivan A. Getting Laboratories, The Aerospace Corporation, Los Angeles, California 90009). *J. Chem. Phys.;* **71**: No. 2, 713-722(15 Jul 1979).

A two-step laser photodissociation technique was used to measure the cross section for photodissociation of HBr(v=1) at 258.9 nm. The cross section was found to be (5.5 +- 1.1) x 10^{-20} cm^2/molecule and is 34 +- 7 times larger than the cross section for photodissociation of HBr(v=0) at the same wavelength. A theoretical estimate of the ratio of cross sections, based on a "reflection approximation" treatment of the UV absorption spectrum of HBr, gave poor agreement with the experimental result. The limitations of simple approximations to the photodissociation process in the threshold region of a photodissociative transition are discussed.

52266 Emission spectrum of berkelium. Worden, E.F.; Conway, J.G. (University of California, Lawrence Livermore Laboratory, Livermore, California 94550). *At. Data Nucl. Data Tables;* **22**: No. 4, 329-366(Oct 1978).

The berkelium emission spectrum was observed from 2540 to 9800 A with an electrodeless lamp as a source. The wavenumber, wavelength, and relative intensities of the 1930 strongest ^{249}BK lines are reported. In addition, information on hyperfine structure, Zeeman effect, spectrum assignment as neutral or singly-ionized lines, and energy level classification is presented for many of the lines. Tables of the known energy levels of the neutral and singly-ionized atoms are given.

POSITRONIUM, MUONIUM, AND MUONIC AND MESIC ATOMS AND MOLECULES

REFER ALSO TO CITATION(S) 52325

52267 Positronium formation in aqueous micellar solutions of sodium dodecylsulfate. Handel, E.D.; Ache, H.J. (Department of Chemistry, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061). *J. Chem. Phys.;* **71**: No. 5, 2083-2087(1 Sep 1979).

Positron annihilation lifetime measurements on aqueous solutions of sodium dodecylsulfate (NaLS) were performed over a wide range of temperatures and surfactant concentrations. The sensitivity of the positronium formation process toward changes in physical properties accompanying micellization is demonstrated. The critical micelle concentration (CMC) is associated with a sharp decrease in positronium formation. The CMC of 8.4 +- 0.5 mM at 20 °C in this system is in agreement with literature values. At higher temperatures the CMC is shifted to slightly higher surfactant concentrations (10.4 +- 0.7 mM at 90 °C). The formation probability for thermal positronium as expressed by I_2, the intensity of the long-lived component in the lifetime spectra, gradually decreases above the CMC with increasing surfactant concentration reaching a limiting value. A model is suggested involving the reactions of "hot" positrons or positronium atoms with micellar aggregates leading to the observed reduction of thermalized positronium atoms.

COLLISION PHENOMENA

REFER ALSO TO CITATION(S) 52262

52268 (AD-A—060616) **Molecular energy transfer studies. Final report, 1 October 1976—31 July 1978.** Shin, H.K. (Nevada Univ., Reno (USA). Dept. of Chemistry). 31 Jul 1978. 8p. Y A02/MF A01.

The major objective of this project was to develop theoretical models and techniques for describing vibrational relaxation in molecular collisions at low temperatures. If attractive forces are sufficiently strong, the colliding molecules can form a weakly bound complexes. Models have been developed to provide both a quantitative and a qualitative interpretation of the mechanisms and dynamics of intercomplex energy transfer processes. The processes considered in the investigation are; DF(v=1) + DF(v=0), H_2O(010) + H_2O(000), D_2O(010) + D_2O(000), and HCl(v=1) + Cl. The investigation included the determination of energy levels of newly formed bonds and internal oscillatory motions. In addition, the following aspects of molecular collisions have also been investigated; vibration-vibration energy transfer in CO2(00 deg. 1) + H2/D2, F-atom deexcitation of DF(v=1), approximate solution of the time-dependent Schrodinger equation for vibration-vibration energy transfer, and exact quantum mechanical treatment of vibration-translation energy transfer employing a step potential.

52269 **Classical models for electronic degrees of freedom: Derivation via spin analogy and application to $F^* + H_2 \rightarrow F + H_2$.** Meyer, H.; Miller, W.H. (Department of Chemistry and Materials and Molecular Research Division of the Lawrence Berkeley Laboratory, University of California, Berkeley California 94720). *J. Chem. Phys.;* **71**: No. 5, 2156-2169(1 Sep 1979).

By invoking the formal equivalence of a finite level quantum mechanical system to a quantum spin in an external field, this paper shows how a classical model can be constructed for an arbitrary finite level quantum system. For two-state and three-state cases this leads to the same classical Hamiltonian that was obtained earlier by other more heuristic methods, but it shows how to treat the general F-state case. The purpose of this overall approach is to be able to represent the electronic states in electronically nonadiabatic collision processes by a classical degree of freedom so that all degrees of freedom, electronic and heavy particle (i.e., translation, rotation, and vibration) can be treated on a consistent dynamical footing. Application of this model to the quenching of F^* (^2P/sub 1/2/) by collisions with H_2 is described, and this completely classical approach is seen to give excellent agreement with the quantum mechanical coupled channel calculations of Rebentrost and Lester.

52270 **Limiting slope of the generalized oscillator strength vs momentum transfer curve.** Huo, W.M. (Radiation Laboratory University of Notre Dame, Notre Dame, Indiana 46556). *J. Chem. Phys.;* **71**: No. 4, 1593-1600(15 Aug 1979).

Although at the limit of zero momentum transfer, the generalized oscillator strength is equal to the Born value [E. N. Lassettre, A. Skerbele, and M. A. Dillon, J. Chem. Phys. 50, 1829 (1969)], it is found that the limiting slopes (df/dK)/sub K/=0 and (df/dK^2)/sub K/=0 do not obey the Born approximation. For dipole allowed transitions (df/dK)/sub K/=0 is nonzero but finite and (df/dK^2)/sub K/=0 becomes infinite at all finite incident energies. Also, the non-Born correction to f_0 deduced from zero angle data is just as important as the next higher multiple term in the Born approximation. Thus in the analytic fit of experimental data it is imperative to include odd power terms in K even when the Born approximation is apparently obeyed if the purpose is to deduce the limiting slope as well as the intercept. However, if only the intercept is needed and the measured f's shows no apparent energy dependence, it is still possible to extrapolate to f_0 using a series even in K. The relevance of the present result to a number of recent electron impact experiments is discussed.

52271 **Inelastic scattering of Cl^- ions in collision with H_2 from 4 to 11 eV.** Cheung, J.T.; Datz, S. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *J. Chem. Phys.;* **71**: No. 4, 1814-1818(15 Aug 1979).

We have utilized the time-of-flight (TOF) technique to measure the energy loss of Cl^- ions backscattered from H_2 in the relative energy region of 4 to 11 eV. For relative energy less than 7 eV, this collision yields vibrational excitation of the H_2 molecule and the amount of energy transferred is similar to that in the isoelectronic analog, i.e., K^+—H_2. In the case of K^+, the results were in good agreement with an exact classical calculation involving only the particle masses, the K^+—H_2 repulsion, and the H_2 potential. At higher relative energy (E/sub rel/>7 eV), however, the process is much more inelastic with a minimum energy loss of greater than 4 eV, corresponding to dissociation of the H_2 molecules. The threshold for dissociation observed here is more commensurate with that predicted for a strong $[H_2Cl]^-$ surface than with simple T—V transfer kinetics.

52272 **Energy dependence of the differential cross sections for simple models of ion-induced dipole capture collisions.** Bearman, G.H.; Gentry, W.R. (Chemical Dynamics Laboratory, Department of Chemistry, University of Minnesota, Minneapolis, Minnesota 55455). *J. Chem. Phys.;* **71**: No. 3, 1128-1133(1 Aug 1979).

At low relative kinetic energies, the product angular distributions characteristic of the short range part of a reactive scattering event may become distorted by a long range attractive force. We examine this behavior for several different simple models of direct, short range encounters, each of which is coupled at long range to an attractive potential term proportional to r^{-4}. The long range attraction does not generally lead to symmetric angular distributions for low-energy capture collisions. The anisotropy of the differential cross section which is observed at high energies may be preserved at extremely low kinetic energies, or it may be substantially altered toward either more symmetric or less symmetric distributions. It is even possible for a distribution which is forward-peaked at high energy to become backward-peaked at low energy, and vice versa. These results suggest that caution is warranted when one wishes to interpret a change in the product angular distribution, in going from high kinetic energies to low kinetic energies, as due to a change in the short range reaction mechanism.

52273 **Reactive quenching studies of Xe (6s, $^3P_2$) metastable atoms by chlorine containing molecules.** Kolts, J.H.; Velazco, J.E.; Setser, D.W. (Chemistry Department, Kansas State University, Manhattan, Kansas 66506). *J. Chem. Phys.;* **71**: No. 3, 1247-1263(1 Aug 1979).

The XeCl* emission spectrum has been used to study the reactions of Xe (6s, $^3P_2$) metastable atoms with 20 chlorine containing reagents. Although the total quenching rate constants are large, only Cl_2, the mixed halogens and Group VI chlorides have high product branching fractions for XeCl* excimer formation. From analysis of the low pressure XeCl* emission spectra, the ratios for XeCl (III,1/2 or B,1/2) and XeCl (II,3/2 or C,3/2) formation were determined. Using results presented in the following paper, the vibrational energy distributions of the XeCl* molecules also can be estimated. A wide difference, depending upon reagent, is observed for the vibrational energy disposal. The short wavelength limit of the XeCl (B—X) emission can be used to assign upper limits to D^0_0 (R—Cl) and this work gives D^0_0 (SCl—Cl) < or =44.7; D^0_0 (ClS_2—Cl) < or =46.2, D^0_0 (SOCl—Cl) < or =53.9; D^0_0 (SO_2—Cl) < or =58.5, and D^0_0 (PCl_2—Cl) < or =77.7 kcal $mole^{-1}$. For purposes of comparison, the XeCl* emission spectra also were obtained from the reaction of Xe (6s, $^3P_1$) resonance atoms with Cl_2, PCl_3, CCl_4, and $COCl_2$. The branching ratios and energy disposal for Xe ($^3P_2$) and Xe ($^3P_1$) reactions appear to be qualitatively similar. Based upon all of these data, the dynamics of the reactions between Xe ($^3P_2$) and the chlorine containing reagents are discussed and compared to the models in the literature used previously for the reactions of alkali metal atoms with halogen containing molecules. Characteristic XeI* and XeBr* spectra from Xe ($^3P_2$) atom reactions are included in an Appendix.

52274 **L-series satellite spectra in Ti XII and Fe XVI.** Burkhalter, P.G.; Cohen, L.; Cowan, R.D.; Feldman, U. (X-Ray Optics Branch, Naval Research Laboratory, Washington, D. C., 20375). *J. Opt. Soc. Am.;* **69**: No. 8, 1133-1140(Aug 1979).

Transitions in Na-like Ti and Fe ions, which appear as satellites to 2p-3s and 2p-3d transitions in Ne-like ions, were studied. The soft x-ray spectra produced by a focused-laser source and a vacuum-spark device were obtained with the same grazing-incidence spectrograph. Atomic structure calculations agreed with the observed 2p-3s spectral patterns and made possible line identifications in Ti XII and Fe XVI.

52275 **Expansion of exchange kernels for reactive scattering.** Adams, J.E.; Miller, W.H. (Univ. of California, Berkeley). *J. Phys. Chem.;* **83**: No. 11, 1505-1508(31 May 1979).

Two methods of treating the exchange kernel appearing in Miller's formulation of reactive scattering are investigated, with the most promising being an improvement of the separate expansion used previously. On the basis of results for the collinear H + H_2 reaction, it appears that calculations within this formalism can be tractable for more general bimolecular reactions. 1 table.

52276 **Optical model analysis of H + H_2 reactive scattering.** Kwei, G.H.; Herschbach, D.R. (Los Alamos Scientific Lab., NM). *J. Phys. Chem.;* **83**: No. 11, 1550-1552(31 May 1979).

A simple semiclassical optical model is found to simulate accurately some results of recent three-dimensional quantum mechanical treatments of H + H_2 reactive scattering. The model postulates two-body central force trajectories with hard-sphere interactions for both reactants and products and invokes a specular reflection approximation to link these trajectories. The product scattering angle θ is thereby related to the reactant impact parameter b and the sphere radius by b ≅ R cos (θ/2). The differential reaction cross section, I/sub r/(θ, E), thus becomes isomorphous with the reaction probability, P/sub r/(b, E), and the I/sub r/ → P/sub r/

transformation becomes independent of E, the collision energy. The quantum results for two potential surfaces obey this relationship equally well, and the appropriate sphere radius R is the same for both surfaces and for the distorted wave and exact quantum scattering treatments. Another version of the optical model analysis uses the isomorphism between I/sub r/(θ, E) and P/sub r/(b, E) to extract the deflection function θ(b) without presuming a functional form. The results again confirm the utility of the specular reflection approximation for the wide-angle or rebound scattering with $\theta \geqq 90^0$. 3 figures.

52277 Impact-parameter dependence of Ag K X-rays produced by bombardment of Ag by I. Guillaume, G.; Fintz, P.; Jundt, F.C. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires); Jones, K.W.; Johnson, B.M. (Brookhaven National Lab., Upton, NY (USA)). *Phys. Lett., A;* **68**: No. 1, 39-41(18 Sep 1978).

The impact-parameter dependence of Ag Kα and Kβ X-rays produced by 47 and 100 MeV ions incident on solid Ag targets has been measured. A striking difference found for the impact-parameter dependence of the Ag Kα and Kβ radiations demonstrates a variation in relative outer-shell populations which may affect the K-vacancy production mechanisms. K-vacancy production probabilities were determined from the data. The results are compared with the theoretical predictions of the molecular orbital and statistical models.

ATOMIC AND MOLECULAR THEORY

REFER ALSO TO CITATION(S) 51915

52278 Cubic and quartic anharmonic potential energy functions for octahedral XY_6 molecules. Fox, K.; Krohn, B.J.; Shaffer, W.H. (Department of Physics and Astronomy, University of Tennessee, Knoxville, Tennessee 37916). *J. Chem. Phys.;* **71**: No. 5, 2222-2228(1 Sep 1979).

We give the cubic and quartic anharmonic potential energy functions for XY_6 molecules of O/sub h/ symmetry in terms of normal coordinates. The numbers of independent cubic and quartic potential constants are 22 and 92, respectively. A standard form, introduced here, is related to the tensor formalism developed for the potential energy of tetrahedral XY_4 molecules by Hecht.

52279 Vibrational energy disposal by reaction of Xe(6s, $^3P_2$) metastable atoms with chlorine containing molecules. Tamagake, K.; Kolts, J.H.; Setser, D.W. (Chemistry Department, Kansas State University, Manhattan, Kansas 66505). *J. Chem. Phys.;* **71**: No. 3, 1264-1275(1 Aug 1979).

The bound—free XeCl spectra observed from the reactions of Xe(6s, $^3P_2$) atoms with Cl_2, PCl_3, CCl_4, and $COCl_2$ have been compared to computer simulated spectra in order to assign the XeCl* vibrational energy distributions from these reactions. The <f/sub V/> values for the initial state distributions are between 0.6—0.8 for Cl_2 and CCl_4 and 0.2—0.3 for $COCl_2$. The results for PCl_3 are unusual in that the distribution for the XeCl (B) and XeCl (C) states apparently differ, with the <f/sub V/ values being ~0.47 and 0.64, respectively. This selection of reactions represents most types of XeCl spectra that have been observed and the vibrational energy disposal to XeCl by other Xe($^3P_2$) + RCl reactions can be estimated by comparison with these results. Model potentials, as well as the ab initio potentials of Hay, were used to represent the XeCl states for the simulation. Simulations were done for both the XeCl (B,1/2—X,1/2) and for the XeCl (C,3/2—A,3.2) transitions. The XeCl (B,1/2—X,1/2) transition is the more useful for assigning vibrational distributions because it is less sensitive to the shape of the lower potential. The dependence of the derived vibrational distributions upon the XeCl potentials and the variation of the transition moment with internuclear separation is discussed. The vibrational energy disposal for Xe ($^3P_2$)+Cl_2 also is compared to that for Xe ($^3P_2$)+F_2 and Kr ($^3P_2$)+F_2.

52280 Detailed study of the Lane potential: Multichannel and polarization constraints. Byrd, R.C.; Walter, R.L.; Cotanch, S.R. (Department of Physics, Duke University, Durham, North Carolina 27706). *Phys. Rev. Lett.;* **43**: No. 4, 260-263(23 Jul 1979).

A Lane-model analysis of the ^{9}Be + nucleon system has provided a detailed description of both cross-section and polarization data for (p,p) elastic, (n,n) elastic, and (p,n) quasielastic scattering over a range of energies. Emphasis is placed on consistency in isospin conservation, data-set completeness, and multichannel constraints. Results favor a symmetry potential which is energy dependent with volume and surface form factors for the real and imaginary wells, respectively. A symmetry spin-orbit (lxsigma-arrow-right)(txT) interaction was found to be unnecessary.

52281 Permanent and induced dipole requirements in ab initio calculations of electron affinities of polar molecules. Garrett, W.R. (Chemical Physics Section, Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *J. Chem. Phys.;* **71**: No. 2, 651-658(15 Jul 1979).

Through the use of a molecular pseudopotential method, we determine the a approximate magnitudes of errors that result when electron affinity determinations of polar negative ions are made through ab initio calculations in which the use of a given basis set yields inappropriate values for permanent and induced dipole moments of the neutral molecule. These results should prove useful in assessing the adequacy of basis sets in ab initio calculations of molecular electron affinities for simple linear polar molecules.

52282 Variational method and the stochastic—Liouville equation. III. Infinite elements for CIDN(E)P. Zientara, G.P.; Freed, J.H. (Department of Chemistry, Cornell University, Ithaca, New York 14853). *J. Chem. Phys.;* **71**: No. 2, 744-749(15 Jul 1979).

The variational finite-element method introduced by Zientara and Freed for the solution of the stochastic-Liouville equation is modified to utilize the advantages of an infinite outer element. Within this infinite element, the correct asymptotic forms of the solutions may be used, and they may be matched to those of the inner finite elements. Large reductions in the computational effort are realized by this scheme while maintaining high accuracy as illustrated in the example of high-field chemically induced dynamic spin polarization. Applicability of this method extends to solutions of partial differential equations in chemical physics characterized by a large spatial region with simple interactions and a restricted region in which more complex behavior occurs, such as is found in treatments of chemical reactions modulated by liquid state diffusive processes and in scattering theory in quantum mechanics.

52283 Ab initio calculation of spin densities in hydrocarbon radicals. Chipman, D.M. (Radiation Laboratory, University of Notre Dame, Notre Dame, Indiana 46556). *J. Chem. Phys.;* **71**: No. 2, 761-768(15 Jul 1979).

Ab initio calculations are reported for the isotropic hyperfine coupling constants arising from contact spin density distributions in hydrocarbon radicals. Representative sigma radicals (vinyl and ethynyl), nonconjugated pi radicals (methyl and ethyl), and conjugated pi radicals (allyl and cyclohexadienyl) are examined in the unrestricted Hartree-Fock approximation with a wide variety of Gaussian basis sets, ranging from crude minimal sets to a large uncontracted set. The unrestricted Hartree—Fock method itself gives poor results for this property, but is found to yield results of semiquantitative accuracy after a spin projection is performed. Some significant differences are found between results after full quartet annihilation and after complete spin projection. Due to a systematic cancellation of errors, the crude minimal STO-3G basis set gives generally better results than more sophisticated minimal basis sets. Extended basis sets give only a slight overall improvement on the STO-3G results. The standard contraction schemes for large Gaussian basis sets are found to be quite appropriate for spin density calculations. It is concluded that the projected unrestricted Hartree—Fock method can be a useful tool for study of spin density distributions in hydrocarbon radicals even when deployed with highly contracted Gaussian basis sets.

GENERAL FLUID DYNAMICS

52284 Brownian motion in a flowing fluid. Ramshaw, J.D. (Theoretical Division, University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *Phys. Fluids;* **22**: No. 9, 1595-1601(Sep 1979).

A phenomenological theory is developed for Brownian motion in a flowing incompressible fluid. The Brownian particles are regarded as an ideal gas subject to a position- and time-dependent force field that represents interactions with the host fluid. Ths approach immediately leads to deterministic partial differential equations of motion for the Brownian particles. These equations are then examined in the limit of large friction, in which they imply an expression for the diffusional mass flux of Brownian particles. This expression is a sum of terms representing concentration, forced, thermal, and pressure diffusion. Comparisons are made with earlier work, and with the corresponding expression for the molecular diffusion flux of one component in a binary ideal-gas mixture. The Brownian and molecular diffusion fluxes are found to be identical in form, with the Brownian-particle volume fraction corresponding to the molecular mole fraction.

52285 Tensor viscosity method for convection in numerical fluid dynamics. Dukowicz, J.K.; Ramshaw, J.D. (University of California, Los Alamos Scientific Laboratory, Los Alamos. New Mexico 87545). *J. Comput. Phys.;* **32**: No. 3, 71-79(Jul 1979).

A new method, called the tensor viscosity method, is described for differencing the convective terms in multidimensional numerical fluid dynamics. The method is the proper generalization to two or three dimensions of interpolated donor cell differencing in one dimension, and is designed to achieve numerical stability with

minimal numerical damping. It is a single-step method that is distinguished by simplicity and case of implementation, even in the case of an arbitrary non-rectangular mesh. It should therefore be useful in finite-element as well as finite-difference formulations.

PROPERTIES AND STRUCTURE OF FLUIDS

52286 **High-repetition-rate short-pulse gas discharge.** Tulip, J.; Seguin, H.; Mace, P.N. (Department of Electrical Engineering, University of Alberta, Alberta, Canada). *Rev. Sci. Instrum.;* **50**: No. 9, 1108-1114(Sep 1979).

A high-average-power short-pulse gas discharge is described. This consists of a volume-preionized transverse discharge of the type used in gas lasers driven by a Blumlein energy storage circuit. The Blumlein circuit is fabricated from coaxial cable, is pulse-charged from a high-repetition-rate Marx-bank generator, and is switched by a high-repetition-rate segmented rail gap. The operation of this discharge under conditions typical of rare-gas halide lasers is described. A maximum of 900 pps was obtained, giving a power flow into the discharge of 30 kW.

SUPERFLUIDITY

52287 (AD-A—060391) **Acoustic microscopy at cryogenic temperatures. Annual summary report, 1 July 1977—30 June 1978.** Quate, C.F.; Heiserman, J. (Stanford Univ., CA (USA). Edward L. Ginzton Lab.). 29 Sep 1978. Contract N00014-77-C-0412. 22p. Y A02/MF A01.

During the past year work has been accomplished on developing an acoustic microscope in superfluid helium. In order to test the apparatus, the authors have studied its behavior using focused beams in water and a plane beam in helium. Images of various objects have been produced using water and liquid argon as propagating media. Some initial work has been done towards producing quarter wave matching layers to reduce the interface loss between the lens material and the liquid helium.

PARTICLE INTERACTIONS AND PROPERTIES - EXPERIMENTAL

STRONG BARYON-INDUCED INTERACTIONS

REFER ALSO TO CITATION(S) 52288

STRONG MESON-INDUCED INTERACTIONS

52288 **Experimental study of low-p/sub t/ hadron fragmentation.** Cutts, D.; Dulude, R.S.; Lanou, R.E. Jr.; Massimo, J.T.; Meunier, R.; Brenner, A.E.; Carey, D.C.; Elias, J.E.; Garbincius, P.H. (Brown University, Providence, Rhode Island 02912). *Phys. Rev. Lett.;* **43**: No. 5, 319-322(30 Jul 1979).

We present high-statistics results on the reactions a + p → c + X where a and c can be any of π^+, K^{+-}, p, or p-bar. The data were taken at 100 and 175 GeV/c incident momenta using the Fermilab Single-Arm Spectrometer operated over the kinematic range 0.2 < x < 1.0 and p/sub t/ < or = 1.0 GeV/c. Investigating the x dependence of the data, we find agreement with a quark-parton picture, namely the cross sections have a power-law behavior in 1 - x independent of p/sub beam/ and p/sub t/.

PARTICLE INTERACTIONS AND PROPERTIES - THEORETICAL

GENERAL

52289 **Infrared properties of quark gas.** Kapusta, J.I. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Phys. Rev., D;* **20**: No. 4, 989-995(15 Aug 1979).

Infrared properties of quark gas at finite density are studied using renormalization-group-improved perturbation theory. The running coupling constant shows color charge screening in the infrared region and asymptotic freedom in the ultraviolet region. Color density correlations are finite. Instanton contributions to the partition function are estimated and found to be large at low density. Possible ambiguities of the perturbation expansion in the many-body medium are discussed.

ELECTROMAGNETIC INTERACTIONS

52290 (CU-TP—133) **Unified weak and electromagnetic interactions, baryon number nonconservation and the Atiyah—Singer theorem.** Christ, N.H. (Columbia Univ., New York (USA). Dept. of Physics). 1977. Contract EY-76-C-02-2271. 11p. P 02/MF A01.

The Weinberg—Salam model is described. Also following t'Hooft, the relation between the Pontryagin index, the Adler anomaly, and the nonconservation of baryon number is discussed. It is shown how the Atiyah—Singer theorem implements this nonconservation of baryon number in a semiclassical, Euclidean space calculation. 7 references. (JFP)

52291 (SLAC-PUB—2324) **Hadroproduction of massive lepton pairs and QCD.** Berger, E.L. (Stanford Linear Accelerator Center, CA (USA)). Apr 1979. Contract DE-AC03-76SF00515. 35p. (CONF-790150—3). P 03/MF A01.

From Orbis scientiae 1979 conference; Coral Gables, FL, USA (15 Jan 1979).

A survey is presented of some current issues of interest in attempts to describe the production of massive lepton pairs in hadronic collisions at high energies. I concentrate on the interpretation of data in terms of the parton model and on predictions derived from quantum-chromodynamics (QCD), their reliability and their confrontation with experiment. Among topics treated are the connection with deep-inelastic lepton scattering, universality of structure functions, and the behavior of cross-sections as a function of transverse momentum.

52292 **Model for the generation of leptonic mass.** Fryberger, D. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Phys. Rev., D;* **20**: No. 4, 952-971(15 Aug 1979).

A self-consistent model for the generation of leptonic mass is developed. In this model it is assumed that bare masses are zero, all of the (charged) leptonic masses being generated by the QED self-interaction. A perturbation expansion for the QED self-mass is formulated, and contact is made between this expansion and the work of Landau and his collaborators. In order to achieve a finite result using this expansion, it is assumed that there is a cutoff at the Landau singularity and that the functional form of the (self-mass) integrand is the same beyond that singularity as it is below. Physical interpretations of these assumptions are discussed. Self-consistency equations are obtained which show that the Landau singularity is in the neighborhood of the Planck mass. This result implies that, as originally suggested by Landau, gravitation may play a role in an ultraviolet cutoff for QED. These equations also yield estimates for the (effective) number of additional pointlike particles that electromagnetically couple to the photon. This latter quantity is consistent with present data from e^+e^- storage rings.

52293 **Flux loops: more new heavy particles in the Weinberg-Salam model.** Einhorn, M.B. (Michigan Univ., Ann Arbor (USA). Dept. of Physics); Savit, R. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Phys. Lett., B;* **77**: No. 3, 295-298(14 Aug 1978).

Extending Nambu's suggestion that there are stringlike classical solutions in the Weinberg-Salam model, the authors argue that these include closed tori of weak neutral (Z^0) flux.

WEAK INTERACTIONS

REFER ALSO TO CITATION(S) 52290, 52294

STRONG INTERACTIONS, GENERAL

52294 **CP violation and instantons.** Han, C.G. (Department of Physics, Columbia University, New York, New York 10027). *Phys. Rev., D;* **20**: No. 4, 996-1001(15 Aug 1979).

Using simplified models of CP-noninvariant weak interactions, we have studied the induced strong CP violation. Even in the simple examples studied, the CP-violating phase of a vacuum-to-vacuum transition amplitude differs in general from the phase of the determinant of the quark mass matrix multiplied by the topological charge of the background Yang-Mills field.

STRONG INTERACTIONS, BARYON NO.=1

REFER ALSO TO CITATION(S) 52290

PARTICLE INVARIANCE PRINCIPLES AND SYMMETRIES

GENERAL

52295 **Extrapolation of lattice gauge theories to the continuum limit.** Duncan, A.; Vaidya, H. (Department of Physics, Columbia University, New York, New York 10027). *Phys. Rev., D;* **20**: No. 4, 903-914(15 Aug 1979).

The problem of extrapolating lattice gauge theories from the strong-coupling phase to the continuum critical point is studied for the Abelian [U(1)] and non-Abelian [SU(2)] theories in three (space-time) dimensions. A method is described for obtaining the asymptotic behavior, for large β, of such thermodynamic quantities and correlation functions as the free energy and Wilson loop function. Certain general analyticity and positivity properties (in the complex β plane) are shown to lead, after appropriate analytic remappings, to a Stieltjes property of these functions. Rigorous theorems then guarantee uniform and monotone convergence of the Pade approximants, with exact pointwise upper and lower bounds. The first three Pade approximants are computed for both the free energy and the Wilson function. For the free energy, we obtain satisfactory agreement with the asymptotic behavior computed by an explicit lattice calculation. The strong-coupling series for the Wilson function is found to be considerably more unstable in the lower-order terms: correspondingly, convergence of the Pade approximants is found to be slower than in the free-energy case. It is suggested that higher-order calculations may allow a reasonably accurate determination of the string constant for the SU(2) theory.

52296 Dynamical basis for the Poincare stresses. Mannheim, P.D. (Stanford Linear Accelerator Center, CA (USA)). *Nucl. Phys., B;* **143**: No. 2, 285-300(16 Oct 1978).

The possibility is explored that the Poincare stresses needed to stabilize a completely electrodynamical electron arise through a phase transition in the vacuum. By extending previous work on dynamical symmetry breaking in finite quantum electrodynamics the author is able to look for extended structure to see whether a composite electron could be stabilized by critically polarizing its own negative energy sea.

APPLICATIONS TO ELECTROMAGNETIC AND WEAK INTERACTIONS

52297 Parameter counting for multimonopole solutions. Weinberg, E.J. (Department of Physics, Columbia University, New York, New York 10027). *Phys. Rev., D;* **20**: No. 4, 936-944(15 Aug 1979).

SU(2) magnetic monopole solutions are considered in the Prasad-Sommerfield limit. It is shown that any solution with n units of magnetic charge belongs to a (4n - 1) -parameter family of solutions. It is conjectured that these parameters correspond to the positions and relative U(1) orientations of n noninteracting unit monopoles.

FIELD THEORY

REFER ALSO TO CITATION(S) 52290, 52296

52298 Instability of Abelian field configurations in Yang-Mills theory. Sikivie, P. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Phys. Rev., D;* **20**: No. 4, 877-880(15 Aug 1979).

It is shown that static purely electric or purely magnetic Abelian field configurations in Yang-Mills theory are unstable when the electric or magnetic field strength is too large over too wide a region. The critical parameter is gEL^2 (gBL^2), where E (B) is a measure of the field strength and L is a measure of the distance over which such field strengths extend.

52299 Explicit solutions for the 't Hooft transformation. Khuri, N.N.; McBryan, O.A. (Rockefeller University, New York, New York 10021). *Phys. Rev., D;* **20**: No. 4, 881-886(15 Aug 1979).

The 't Hooft transformation is a change of variables of the renormalized coupling constant to a new coupling parameter such that the resulting Gell-Mann—Low (GML) function is a low-order polynomial with coefficients independent of renormalization scheme. Explicit expressions for this transformation are given for (phi^4)/sub d/, d = 2,3,4, field theories, QED, and quantum chromodynamics. The solutions are expressed in terms of the original GML function β (g) and their properties are given in some detail. In several cases these transformations are shown to be valid up to the first nontrivial zero of β (g).

52300 Conserved quantities in classical Yang-Mills theory. Chodos, A. (Yale University, Physics Department, J. W. Gibbs Laboratory, New Haven, Connecticut 06520). *Phys. Rev., D;* **20**: No. 4, 915-920(15 Aug 1979).

A method is presented which generates a complete set of conserved quantities in classical non-Abelian gauge theory. The set is complete in the sense that its specification completely determines the time evolution of the system. The usual space-time symmetries are shown to belong to the set. The method is also applied to the anharmonic oscillator in an appendix.

52301 Pion form factor. Farrar, G.R.; Jackson, D.R. (California Institute of Technology, Pasadena, California 91125). *Phys. Rev. Lett.;* **43**: No. 4, 246-249(23 Jul 1979).

We give the normalized leading asymptotic Q^2 dependence of the pion form factor in quantum chromodynamics: F/sub [/(Q^2) → / sub Q/2/sub arrow-rightplus-or-minusinfinity/-2f/sub [/ ^{2}/ bQ^{2}lnvertical-barQ^{2}vertical-bar, where f/sub [/ is the pion decay constant and b = (11-2/3N/sub f/)/16π^2. Up to non—leading-logarithmic corrections, this is equivalent to F/sub [/(Q^2) → /sub Q/2/sub arrow-rightplus-or-minusinfinity/8$\pi\alpha$/sub s/(Q^2) f/sub [/ ^{2}/(-Q^2). These results are obtained by solving the light-cone pion Bethe-Salpeter equation in quantum chromodynamics to leading-logarithmic accuracy.

SCATTERING THEORY

52302 Unified connected theory of few-body reaction mechanisms in N-body scattering theory. Polyzou, W.N.; Redish, E.F. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). *Ann. Phys. (N.Y.);* **119**: No. 1, 1-42(May 1979).

We develop a complete N-body reaction theory that can emplasize any reaction mechanism. Our formalism is based on a system of connected kernel integral equations; one describing the dynamics of the reaction mechanism in a unitary way, one describing the dynamics of the excluded processes in a unitary way, and one combining these to get the full N-body dynamics. To do this we introduce a new democratic decomposition of the full Hamiltonian in terms of proper partition Hamiltonians as follows: H=Σ/sub a/C/ sub a/H/sub a/ where the C/sub a/'s are combinatoric coefficients. The set of asympototic channels, A_0, may be divided into the physically important channels A, and the remainder A'. The sets A and A' of asymptotic channels are referred to as reaction mechanisms (RM's). By making a spectral resolution of each partition Hamiltonian, parts corresponding to each RM may be identified. Using the above expansion this gives a decomposition of full Hamiltonian by reaction mechanism, H=H (A)+H (A'), depending only on the spectral properties of the partition Hamiltonians. We define the RM resolvent by G (A) = (Z-H (A)$^{-1}$ and G (A') = (Z-H (A')$^{-1}$. We derived connected kernel equations for these operators using solutions of fewer body problems as input. The full resolvent may then be obtained as the solution of a connected kernel equation involving G (A) and G (A'). Transition operators associated with G (A) and G (A') are shown to satisfy optical theorems where all of the scattered flux comes through the channels of A and A' respectively. If A is chosen to only include channels having no more than three or four clusters, the equations for G (A) have the numerical simplicity of a few body problem. This formulation should be useful for serious evaluations of existing reaction models, and in developing new reaction models that can emphasize any given RM including breakup, rearrangement, and those involving overlapping clustering.

PHYSICS RESEARCH (CONT.)

NUCLEAR PHYSICS

52303 (BNL-NCS—51023) Minutes of the third annual meeting of the Panel on Reference Nuclear Data. Burrows, T.W.; Stewart, L.; Coyne, J.J. (eds.). (Brookhaven National Lab., Upton, NY (USA); Los Alamos Scientific Lab., NM (USA); National Bureau of Standards, Washington, DC (USA). Center for Radiation Research). May 1979. Contract EY-76-C-02-0016. 65p. P 04/MF A01.

The major activities of the meeting were as follows: welcome; organization, approval of minutes of the second meeting, and approval of agenda; review of nuclear data compilation and evaluation efforts (national and international efforts, master data files, publications); summary of 1977 panel meeting; definition of reference nuclear data; discussion of specific data needs and possible data center contributions (reactor physics, medicine and biology, controlled thermonuclear reactors and astrophysics); establishment of current interest and future direction of the panel; adjournment. Recommendations and action items are listed. Tables on nuclear data needs in applied physics, medicine and biology, and controlled thermonuclear reactors and astrophysics are presented. Appendixes include membership lists of various committees, summaries of publication activities, survey results, correspondence, and portions of the documents Proceedings of the Magnetic Fusion Energy Blanket and Shield Workshop and National Needs for Critically Evaluated Physical and Chemical Data. (RWR)

52304 (UCID—17271-79) E-Division activities report. Barschall, H.H. (comp.). (California Univ., Livermore (USA). Lawrence

Livermore Lab.). Jul 1979. Contract W-7405-ENG-48. 44p. P 03/ MF A01.

This report describes some of the activities in E (Experimental Physics) Division during the past year. E-Division carries out research and development in areas related to the missions of the Laboratory. Many of the activities are in pure and applied atomic and nuclear physics. In addition, this report describes work on accelerators, radiation damage, microwaves, and plasma diagnostics.

NUCLEAR PROPERTIES AND REACTIONS, A=1-5, THEORETICAL

NUCLEAR REACTIONS AND SCATTERING

52305 Noncoplanar ^{2}H(p,2p) n reaction. Bonbright, D.I.; McDonald, A.M.; van Oers, W.T.H.; Watson, J.W.; Caplan, H.S.; Cameron, J.M.; Rogers, J.G.; Soukup, J.; Kloet, W.M.; Stolk, C.; Tjon, J.A. (Cyclotron Laboratory, Department of Physics, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada). *Phys. Rev., C;* **20**: No. 3, 879-891(Sep 1979).

Calculations based upon the Faddeev equations and measurements of proton-induced deuteron disintegration cross sections have been made at 23.0 and 39.5 MeV for two types of constant-relative-energy loci. In the first configuration the variation of the breakup cross section was studied for fixed values of the final state NN relative energies and a fixed momentum of one of the emerging protons. In the second configuration the variation of the breakup cross section was studied for equal relative energies between all three pairs of nucleons with the two protons emerging with equal momenta symmetrically with respect to the incident beam direction. At 39.5 MeV calculations and measurements were made of both types of loci while at 23.0 MeV only the second kinematical configuration was studied.

NUCLEAR PROPERTIES AND REACTIONS, A=1-5, EXPERIMENTAL

RADIOACTIVE DECAY

REFER ALSO TO CITATION(S) 52314

NUCLEAR REACTIONS AND SCATTERING

52306 Direct-reaction and isospin symmetries in d + d reactions. Brown, R.E.; Correll, F.D.; Haglund, R.F. Jr.; Hardekopf, R.A.; Jarmie, N.; Ohlsen, G.G.; Schmelzbach, P.A. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). *Phys. Rev., C;* **20**: No. 3, 892-896(Sep 1979).

We have measured angular distributions of the analyzing powers A/sub y/, A/sub x/x, A/sub y/y, and A/sub x/z for the ^{2}H(d,p)^{3}H reaction at deuteron lab energies E/sub d/ of 13.39 and 17.00 MeV. These distributions do not show the symmetry or antisymmetry about 90° (c.m.) expected on the basis of a simple direct-neutron-transfer reaction mechanism. In a companion experiment, we have measured the same four analyzing powers for both the ^{2}H(d,p)^{3}H reaction and its charge-symmetric partner ^{2}H(d,n)^{3}He at E/sub d/ = 15.50 and 17.00 MeV in a restricted angular range. These latter data were obtained by simultaneously detecting the tritons and helions. Only small differences were observed in the respective analyzing powers for the two reactions, which suggests a weakening of the mechanism responsible for the larger differences found by others at lower energies.

NUCLEAR PROPERTIES AND REACTIONS, A=6-19 THEORETICAL

RADIOACTIVE DECAY

REFER ALSO TO CITATION(S) 52322

MOMENTS AND SPIN

REFER ALSO TO CITATION(S) 52322

NUCLEAR REACTIONS AND SCATTERING

REFER ALSO TO CITATION(S) 52320

52307 Unified nuclear potential for heavy-ion elastic scattering, fusion, fission, and ground-state masses and deformations. Krappe, H.J.; Nix, J.R.; Sierk, A.J. (Hahn-Meitner-Institut fuer Kernforschung, Berlin, Germany). *Phys. Rev., C;* **20**: No. 3, 992-1013(Sep 1979).

We develop a unified nuclear potential for the description of large-scale nuclear collective motion and find that it satisfactorily reproduces experimental data for heavy-ion elastic scattering, fusion, fission, and ground-state masses. Obtained by generalizing the modified liquid-drop model so that two semi-infinite slabs of constant-density nuclear matter have minimum energy at zero separation, this potential is given in terms of a double volume integral of a Yukawa-plus-exponential folding function. For heavy nuclear systems the resulting heavy-ion interaction potential is similar to the proximity potential of Swiatecki and co-workers. However, for light nuclear systems our potential lies slightly below the proximity potential at all nuclear separations. For heavy nuclei fission barriers calculated with our Yukawa-plus-exponential model are similar to those calculated with the liquid-drop model. However, for light nuclei the finite range of the nuclear force and the diffuse nuclear surface lower the fission barriers relative to those calculated with the liquid-drop model. Use of a Wigner term proportional to absolute value (N - Z)/A in the nuclear mass formula resolves the major part of the anomaly between nuclear radii derived from elastic electron scattering on the one hand and from ground-state masses and fission-barrier heights on the other.

52308 Method of finite-range distorted-wave Born approximation for pickup to unbound ejectiles. Kunz, P.D.; Saha, A.; Fortune, H.T. (Kernfysisch Versneller Institut, Rijksuniversiteit Groningen, Groningen, The Netherlands). *Phys. Rev. Lett.;* **43**: No. 5, 341-343(30 Jul 1979).

A method is outlined for performing finite-range distorted-wave Born-approximation calculations for pickup reactions in which the ejectile is unbound with respect to the transferred particle.

NUCLEAR PROPERTIES AND REACTIONS, A=6-19, EXPERIMENTAL

ENERGY LEVELS AND TRANSITIONS

52309 ^{16}O(d,p)^{17}O reaction to the unbound 5.09-MeV state of ^{17}O. Anderson, B.D.; Jarmie, N.; Barrett, R.J.; Arthur, E.D. (Department of Physics, Kent State University, Kent, Ohio 44242). *Phys. Rev., C;* **20**: No. 3, 897-903(Sep 1979).

New measurements of the ^{16}O(d,p) reaction cross sections to the ground, 0.87-, and 5.09-MeV states in ^{17}O have been performed for eleven angles from 17.5° to 150° at a bombarding energy of 12 MeV. The results are compared with earlier measurements at the same energy. The new measurements are shown to resolve a discrepancy observed for the comparison of the neutron strength of the unbound 5.09-MeV state extracted from earlier (d,p) studies with that from neutron scattering experiments. These results indicate that the method of Vincent and Fortune for distorted-wave analysis of stripping to unbound states yields a reliable value for the neutron width for this important test case. Measurements of ^{16}O(d,d) elastic scattering cross sections performed simultaneously are reported.

NUCLEAR REACTIONS AND SCATTERING

52310 Zero-degree fragmentation of relativistic ^{6}Li. Ruiz, C.L.; Huggett, R.W.; Kirk, P.N. (Department of Physics and Astronomy, Louisiana State University, Baton Rouge, Louisiana 70803). *Phys. Rev. Lett.;* **43**: No. 5, 334-337(30 Jul 1979).

Evidence for the dissociation of relativistic ^{6}Li ions into the channels ^{3}H + ^{3}H + p and ^{3}He + ^{2}H + n is presented. The number of events in each of these secondary channels is approximately 20% of the number of events in the channel ^{6}Li → ^{4}He + ^{2}H. Possible mechanisms for populating the secondary channels are discussed.

NUCLEAR PROPERTIES AND REACTIONS, A=20-38, EXPERIMENTAL

REFER ALSO TO CITATION(S) 52307

NUCLEAR REACTIONS AND SCATTERING

52311 Energy-dependent structure in ^{28}Si + ^{28}Si scattering. Betts, R.R.; DiCenzo, S.B.; Petersen, J.F. (A. W. Wright Nuclear Structure Laboratory, Yale University, New Haven, Connecticut 06520). *Phys. Rev. Lett.;* **43**: No. 4, 253-256(23 Jul 1979).

Data for ^{28}Si + ^{28}Si elastic and inelastic scattering are presented for a range of bombarding energies from 80 to 150 MeV. The experimental results show strong evidence for resonancelike effects similar to those seen in light systems. The inelastic data suggest the dominance of multistep processes.

NUCLEAR PROPERTIES AND REACTIONS, A=59-89, EXPERIMENTAL

REFER ALSO TO CITATION(S) 52307

NUCLEAR REACTIONS AND SCATTERING

52312 Spallation of Cu by π^- across the T = 1/2 resonances and at high energy. Haustein, P.E. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973). *Phys. Rev., C;* **20**: No. 3, 1092-1095(Sep 1979).

Relative yields of 11 selected products (^{24}Na, /sup 43,44,46,47,48/Sc, /sup 55,56,57,58,60/Co) have been measured for the interaction of 0.6- and 0.9-GeV negative pions with Cu. In addition, the yields of ^{24}Na and ^{58}Co from Cu have been measured for 12-GeV π^-. Results at the two lower energies which correspond to the first two isospin T = 1/2 pion-nucleon resonances are compared with earlier studies of Cu spallation by π^- at energies across the first T = 3/2 resonance, i.e., 50 to 350 MeV. The 12-GeV π^- results are compared with similar investigations in which both energetic protons and heavy ions were used. For E/sub π/ > or = 0.5 GeV no evidence of strong resonance effects can be found in the pattern of the spallation yields. As the pion energy is raised a smooth trend of enhanced yields of deep spallation products to near-target yields closely parallels the same trend observed for both high-energy proton and heavy-ion spallation of Cu. These results indicate that at high energy, pi-mesic spallation exhibits the same features of limiting fragmentation and factorization of the isotopic yields that have been observed previously in hadron induced spallation.

NUCLEAR PROPERTIES AND REACTIONS, A=90-149, THEORETICAL

ENERGY LEVELS AND TRANSITIONS

52313 Test of the interacting-boson-approximation model for odd-mass nuclei. Casten, R.F.; Smith, G.J. (Brookhaven National Laboratory, Upton, New York 11973). *Phys. Rev. Lett.;* **43**: No. 5, 337-341(30 Jul 1979).

The interacting-boson-approximation model has recently been extended to odd-A nuclei. The first extensive test of the new model gives good agreement for unique-parity levels in ^{109}Pd, where the particle-rotor model cannot reproduce empirical results.

NUCLEAR PROPERTIES AND REACTIONS, A=90-149, EXPERIMENTAL

RADIOACTIVE DECAY

52314 (PUB—3005) **Table of specific activities of selected isotopes.** Shipley, G. (comp.). (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). [nd]. Contract W-7405-ENG-48. 43p. P 03/MF A01.

The bulk of this publication consists of a table of the half-lives, decay modes, and specific activities of isotopes selected for their particular interest to the Environmental Health and Safety Department, LBL. The specific activities were calculated with a PDP 9/15 computer. Also included in the report is a table of stable isotopes, the Th and U decay chains, a chart of the nuclides for elements 101 through 106, the heavy element region of the periodic table, and a specific activity monograph. 5 figures, 2 tables. (RWR)

NUCLEAR PROPERTIES AND REACTIONS, A=190-219, THEORETICAL

ENERGY LEVELS AND TRANSITIONS

52315 Weak coupling calculation of ^{212}Po using realistic matrix elements. Strottman, D. (Physics Department, State University of New York at Stony Brook, Stony Brook, New York 11794). *Phys. Rev., C;* **20**: No. 3, 1150-1154(Sep 1979).

The structure of the levels of ^{212}Po has been investigated within the model space of the lowest seven neutron and six proton single particle orbits; the matrix elements of Herling and Kuo were used. Agreement between experiment and theory for the lowest six levels, including the recently discovered 8^+, is excellent. The isomer of 2.93 MeV is suggested to have spin 16^+; the 10^+ is not expected to be an isomer.

NUCLEAR REACTIONS AND SCATTERING

REFER ALSO TO CITATION(S) 52320

NUCLEAR PROPERTIES AND REACTIONS, A=190-219, EXPERIMENTAL

REFER ALSO TO CITATION(S) 52316

NUCLEAR PROPERTIES AND REACTIONS, A=220 AND ABOVE, EXPERIMENTAL

52316 (DOE/TIC—10197) **Status of transactinium nuclear data in the Evaluated Nuclear Structure Data File.** Ewbank, W.B. (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 39p. P 03/MF A01.

The organization and program of the Nuclear Data Project are described. An Evaluated Nuclear Structure Data File (ENSDF) was designed to contain most of the data of nuclear structure physics. ENSDF includes adopted level information for all 1950 known nuclei, and detailed data for approximately 1500 decay schemes. File organization, management, and retrieval are reviewed. An international network of data evaluation centers has been organized to provide for a four-year cycle of ENSDF revisions. Standard retrieval and display programs can prepare various tables of specific data, which can serve as a good first approximation to a complete up-to-date compilation. Appendixes list, for A > 206, nuclear levels with lifetimes > or = 1 s, strong γ rays from radioisotopes (ordered by nuclide and energy), and strong α particle emissions (similarly ordered). 8 figures. (RWR)

RADIOACTIVE DECAY

REFER ALSO TO CITATION(S) 52314

ENERGY LEVELS AND TRANSITIONS

52317 Levels in ^{237}U studied by resonant neutron capture. von Egidy, T.; Cizewski, J.A.; McCullagh, C.M.; Malik, S.S.; Stelts, M.L.; Chrien, R.E.; Breitig, D.; Casten, R.F.; Kane, W.R.; Smith, G.J. (Brookhaven National Laboratory, Upton, New York 11973). *Phys. Rev., C;* **20**: No. 3, 944-959(Sep 1979).

Primary and secondary γ rays in ^{237}U from resonant neutron capture in ^{236}U have been measured with the fast chopper facility, the neutron monochromator, and 2- and 24-keV neutron beam filters. A level scheme was constructed including 27 levels with spin and parity assignments. Rotational band members of the Nilsson configurations [631arrow-down], [622up-arrow], [624arrow-down], [631up-arrow], [633arrow-down], and [501arrow-down] and of the vibrational bands {[622up-arrow] - 2^+} and {[631arrow-down] + 0^+} were identified. There are more levels below 800 keV, in particular, K = $1/2^-$ bands, than expected from comparison with ^{235}U and ^{239}U. The neutron binding energy in ^{237}U was determined to be 5125.9 +- 0.5 keV.

NUCLEAR REACTIONS AND SCATTERING

REFER ALSO TO CITATION(S) 52319

52318 (ICP—1050-4) **Fast reactor fission yields for ^{240}Pu and ^{242}Pu.** Maeck, W.J.; Eggleston, R.L.; Erikson, A.L.; Tromp, R.L. (Allied Chemical Corp., Idaho Falls, ID (USA). Idaho Chemical Programs - Operations Office). Feb 1979. Contract EY-76-C-07-1540. 57p. P 04/MF A01.

Absolute fast reactor fission yield data are presented for ^{240}Pu and ^{242}Pu irradiated in EBR-II. The measurement technique was isotope dilution mass spectrometry for over 40 mass numbers.

SPONTANEOUS AND INDUCED FISSION

52319 (JINR-D—7-9734, pp 48-51) **Spontaneous fission properties of ^{259}Fm.** Hulet, E.K.; Lougheed, R.W.; Landrum, J.H.; Wild, J.F. (California Univ., Livermore (USA). Lawrence Livermore Lab.); Hoffman, D.C.; Weber, J.; Wilhelmy, J.B. (Los Alamos Scientific Lab., NM (USA)). 1976.

From Seminar on reactions of heavy ions with nuclei and synthesis of new elements; Dubna, USSR (23 Sep 1975).

The spontaneous fission (SF) of ^{259}Fm was studied. ^{259}Fm is produced by bombarding the ^{257}Fm target with 16-MeV tritons ((t,p) reaction). In addition to measuring the half-life, the fission mass distribution of ^{259}Fm is obtained by measuring the kinetic energy of coincident fragments. Two decay components are determined, one with t/sub 1/2/ approximately equal to 1.5 s and the other much longer lived. The authors calculated the cross sections of 10 mb for the formation of the 1.5-s SF activity. The long-lived activity was identified as a ^{256}Fm isotope from the ^{257}Fm (t, α) ^{256}Es $\rightarrow$ ^{256}Fm reaction. The cross-section ratio of (t, α)/(t,p) is derived as equal 0.7. From measurements of the energies of coincident fission fragments

tentative results of the total kinetic energy (TKE) distribution in the SF of ^{259}Fm are obtained. The TKE for fission events occurring in the first 3s show a broad exceptionally high-energy distribution centered around 229 MeV with a half-width of 29 MeV. The masses associated with these high-energy fissions appear narrowly distributed around mass number 130 to 132.

NUCLEAR THEORY

REFER ALSO TO CITATION(S) 52334

NUCLEAR REACTIONS AND SCATTERING

52320 (LBL—9468) **Comparison of fragmentation calculations within microscopic and macroscopic frameworks.** Morrissey, D.J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1979. Contract W-7405-ENG-48. 14p. (CONF-790743—2). P 02/MF A01.

From Symposium on heavy ion physics from 10-200 MeV/A; Upton, NY, USA (16 Jul 1979).

The calculation of the isotopic production cross sections from high-energy heavy-ion reactions has proceeded along two divergent paths. From the regime of relativistic heavy-ion reactions comes the abrasion—ablation model, which is dependent on the quick nature of these collisions and the separation of the reactant nuclei into participants and spectators. From the intermediate energy regime comes the intranuclear cascade model, where the reaction is treated as a sum of nucleon—nucleon scattering events inside a nuclear potential well. Both frameworks are able to treat projectile as well as target fragmentation. In this report the results of both model calculations are compared with recent experimental data for the fragmenta—ion of 213-MeV/A ^{40}Ar projectiles by ^{12}C nuclei and for the fragmentation of ^{209}Bi target nuclei by a 400-MeV/A ^{20}Ne beam. These comparisons show the importance of the statistical decay process in determining the distribution of final products as well as the deficiencies of the two models. 3 figures.

52321 **Off-shell sensitivity in relativistic Schroedinger and Klein-Gordon optical models of pion-nucleus interactions.** Johnson, M.B.; Ernst, D.J. (Los Alamos Scientific Laboratory of the University of California, Los Alamos, New Mexico 87545). *Phys. Rev., C;* **20**: No. 3, 1064-1073(Sep 1979).

The elastic scattering of pions from finite nuclei is examined theoretically within the context of the impulse approximation to the optical potential for the relativistic Schroedinger and Klein-Gordon equations. The kinematical relationships between potentials and wave functions are specified by considerations similar to those discussed by Cammarata and Banerjee. We find: (1) At low energy (T/sub [/ < or ≈ 50 MeV) there is a large difference between the solutions of the two equations. (2) At low energy there is a strong sensitivity to the range of the pion-nucleon interaction, the Klein-Gordon equation being dramatically sensitive. (3) Near the (3-3) resonance there are small differences between the solutions of the two equations and there is only a moderate sensitivity to the range of the interaction. The low energy results are explained in terms of the interaction of pions with nuclear matter. The resonance energy results are explained in simple geometric terms. The large differences between wave functions near the resonance region found by Siciliano and Thaler are not found if one uses the relationships proposed here, although we do find significant differences at lower energies.

RADIOACTIVE DECAY

REFER ALSO TO CITATION(S) 52322

NUCLEAR MODELS

52322 **Axial and magnetic tests for nuclear Dirac wave functions.** Noble, J.V. (Department of Physics, University of Washington, Seattle, Washington 98195). *Phys. Rev., C;* **20**: No. 3, 1188-1191(Sep 1979).

A currently popular Dirac model of nuclear wave functions is examined to determine whether its ratio of "small" to "large" components agrees with recent data on the asymmetry in polarized A = 12 nuclear beta decay, as well as with A = 15 magnetic moments. The magnetic moments agree well, and no clear inconsistency is found with the beta-decay asymmetry, but future experiments on the latter might reveal a problem si.ice theory and experiment disagree by about 1 standard deviation.

RADIATION AND SHIELDING PHYSICS

RADIATION PHYSICS

52323 **Full average radiation of electrons and positrons channeled between the planes of a crystal.** Kheifets, S.; Knight, T. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *J. Appl. Phys.;* **50**: No. 9, 5937-5943(Sep 1979).

The full average radiation intensity of electrons and positrons channeled between crystal planes is calculated. Comparison of the results of these calculations with calculations using the parabolic approximation for the potential well of a channel is presented. The difference can in extreme cases reach two orders of magnitude. Estimates for the positions of the maxima of the frequency spectra are given. The number of quanta averaged over the angular distribution of the particles in a beam are found.

SOLID STATE PHYSICS

52324 **Enhancement of positron annihilation with core electrons.** Bonderup, E.; Andersen, J.U.; Lowy, D.N. (Institute of Physics, University of Aarhus, DK-8000 Aarhus C, Denmark). *Phys. Rev., B: Condens. Matter;* **20**: No. 3, 883-899(1 Aug 1979).

A theoretical treatment is presented of the enhancement of positron annihilation with core electrons in a solid. A first estimate is obtained from the simple result for Coulomb scattering of a single positron-electron pair. For relative velocity v large compared to the Bohr velocity $v_0 = e^2/h$ the enhancement is small, being given approximately by chi-1 = $\pi v_0/v$, where chi is the enhancement factor. Since core electrons typically have velocities much larger than v_0, the enhancement for core annihilation is expected to be small. Modifications due to the fact that the electron is embedded in a system of interacting electrons bound to an atomic nucleus are estimated from calculations partly for an electron gas of high density, and partly for a single electron closely bound to a nucleus. The enhancement is found to be similar to the result for a single, free electron but somewhat reduced in magnitude mainly due to the Pauli exclusion principle. Quantitative estimates of the small enhancement are derived for the core contribution to both the total and the momentum-dependent annihilation rates. The enhancements are much smaller than obtained in earlier treatments, and they lead to corrections for core annihilation which are significantly smaller than those derived from semiempirical estimates.

52325 **Feasibility of using positive muons as probes of defect structure.** Jena, P. (Argonne National Lab., IL (USA)). *Solid State Commun.;* **27**: No. 11, 1249-1253(Sep 1978).

A self-consistent calculation based on the density functional formalism yields the spin density at a muon in a vacant lattice site, which is significantly different from that at a muon in an interstitial site. It is argued that a precision μ^+ spin rotation experiment should be able to detect the difference in spin density.

SUPERCONDUCTIVITY

REFER ALSO TO CITATION(S) 51911

ACOUSTIC, ELECTRIC, MAGNETIC, OPTICAL, AND THERMAL PHENOMENA

REFER ALSO TO CITATION(S) 51907, 51910, 51941, 51942, 51956, 51983, 51994

THEORETICAL PHYSICS

CLASSICAL AND QUANTUM MECHANICS

REFER ALSO TO CITATION(S) 52405

52326 (AD-A—060884) **Locality principle in wave-mechanics (wave mechanics/local density of states/local partition function/cluster methods/moment methods/path integral methods). Technical report, 1 January—25 October 1978.** Kohn, W.; Yaniv, A. (California Univ., San Diego, La Jolla (USA). Dept. of Physics). Oct 1978. Contract N00014-76-C-0050. 15p. Y A02/MF A01.

This paper proves a locality principle for a wave-mechanical particle governed by the Schroedinger equation. It is shown that rho(r,Beta), the Laplace transform of the local density of states n(r,E), depends significantly only on the potential V(r') at points r' near r. The effect of changes of V(r') at distant points r' (abs. val. (r' - r) > d) on rho(r,Beta), decay in a Gaussian fashion with a. This result sheds some light on the locality of physical properties of

extended systems and provides general support for various local methods of calculation.

52327 Semilinear integro-differential equations in Hilbert space. Barbu, V.; Malik, M.A. (Concordia Univ., Montreal, Quebec). *J. Math. Anal. Appl.;* **67**: No. 2, 452-475(Feb 1979).

Existence, uniqueness and asymptotic behavior of solutions to integro-differential equations involving monotone operators are discussed. 18 references.

OPTICS

52328 Frequency analysis of the circumzenithal arc: Evidence for the oscillation of ice-crystal plates in the upper atmosphere. McDowell, R.S. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *J. Opt. Soc. Am.;* **69**: No. 8, 1119-1122(Aug 1979).

The results of a quantitative treatment of the visibility of the circumzenithal arc as a function of solar elevation are compared with records of the arc's occurrence in France and the Netherlands, 1894—1931. Both calculated and observed frequency distributions peak at a solar elevation of 22° (minimum deviation), and the width of the observed frequency distribution can be closely matched with the assumption that plate ice crystals in quiet air undergo oscillations of around 1° from equilibrium. This result agrees with other estimates based on studies of the subsun and parhelic circle. The circumzenithal arc is shown to be vertically polarized, with I/sub vert//I/sub hor/≳ 1.4 in the solar vertical near minimum deviation.

STATISTICAL PHYSICS AND THERMODYNAMICS

52329 Comments on "Efficiency of the solid-state engine made with Nitinol memory material". Mohamed, H.A.; Banks, R.M. (Energy and Environment Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *J. Appl. Phys.;* **50**: No. 9, 6028-6029(Sep 1979).

A recent calculation of the thermal efficiency of a solid-state engine made with a Ni-Ti alloy (Nitinol) has been criticized with reference to the origin of the work output and the deformation behavior of the material.

52330 Reply to "Comments on 'Efficiency of the solid-state engine made with Nitinol memory material' ". Golestaneh, A.A. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439). *J. Appl. Phys.;* **50**: No. 9, 6030-6031(Sep 1979).

In reply to the comments of Mohamed and Banks, we outline the conditions under which a Ni-Ti shape-memory element operates in a solid-state engine. The expression for the energy output of this element, which was used in the original paper, is derived here, and further aspects of the efficiency formula for this engine are explained.

52331 High-density fluid-perturbation theory based on an inverse 12th-power hard-sphere reference system. Ross, M. (University of California Lawrence Livermore Laboratory, Livermore, California 94550). *J. Chem. Phys.;* **71**: No. 4, 1567-1571(15 Aug 1979).

A variational theory is developed that is accurate at normal liquid densities and densities up to 4 times that of the argon triple point. This theory uses the inverse 12th-power potential as a reference system. The properties of this reference system are expressed in terms of hard-sphere packing fractions by using a modified form of hard-space variational theory. As a result of this "bootstrapping," a variational procedure may be followed that employs the inverse 12th-power system as a reference but uses the hard-sphere packing fraction as the scaling parameter with which to minimize the Helmholtz free energy.

52332 Renormalized kinetic theory of nonequilibrium many-particle classical systems. Rose, H.A. (Theoretical Division, Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico). *J. Stat. Phys.;* **20**: No. 4, 415-447(Apr 1979).

The far-from-equilibrium statistical dynamics of classical particle systems is formulated in terms of self-consistently determined phase-space density response, fluctuation, and vertex functions. Collective and single-particle effects are treated on an equal footing. Two approximations are discussed, one of which reduces to the Vlasov equation direct interaction approximation of Orszag and Kraichnan when terms that are explicitly due to particles are removed.

ELECTRICITY AND MAGNETISM

52333 (UCRL—82121) **Efficient numerical procedure for modeling antennas over lossy earth.** Burke, G.J.; Brittingtham, J.N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Jul 1979. Contract W-7405-ENG-48. 8p. (CONF-790908—1). P 02/MF A01.

From AGARD meeting; Spatind, Norway (10 Sep 1979).

When an antenna over a ground plane is modeled by the numerical solution of an integral equation, the equation kernel involves the Sommerfeld integral formulation for the field in the presence of an interface. Direct use of this formulation is limited by excessive computation time and numerical difficulties when the antenna is close to the interface. This paper describes a procedure that is fast, without compromising accuracy, and permits modeling antennas very close to the interface. An efficient interpolation technique is used to obtain the Sommerfeld integral values from a precomputed table. Also, the dominant singular component of the field is separated out and the integration of this component over the current is done analytically to permit evaluation for wires very close to the interface. The method is incorporated into the Numerical Electromagnetics Code (NEC). 1 figure.

MATHEMATICAL PHYSICS

52334 (AD-A—060664) **A generalization of ultraspherical polynomials. Summary report.** Askey, R.; Ismail, M.E.H. (Wisconsin Univ., Madison (USA). Mathematics Research Center). May 1978. Contract DAAG29-75-C-0024. 32p. Y A03/MF A01.

Some old polynomials of L. J. Rogers are orthogonal. Their weight function is given. The connection coefficient problem, which Rogers solved by guessing the formula and proving it by induction, is derived in a natural way and some other formulas are obtained. These polynomials generalize zonal spherical harmonics on spheres and include as special cases polynomials that are spherical functions on rank one spaces over reductive p-adic groups. A limiting case contains some Jacobi polynomials studied by Hylleraas that arose in work on the Yukawa potential.

52335 Statistical properties of many-particle spectra. III. Ergodic behavior in random-matrix ensembles. Pandey, A. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). *Ann. Phys. (N.Y.);* **119**: No. 1, 170-191(May 1979).

The ergodic problem is defined for random-matrix ensembles and some conditions for ergodicity given. Ergodic properties are demonstrated for the orthogonal, unitary and symplectic cases of the Gaussian and circular ensembles, and also for the Poisson ensemble. The one-point measures, viz., the eigenvalue density, the number statistic and the k'th-nearest-neighbor spacings are shown to be ergodic and the ensemble variances of the corresponding spectral averages are explicity calculated. It is moreover shown, by using Dyson's cluster functions, that all the k-point correlation functions are themselves ergodic as are therefore the fluctuation measures which follow from them. It is proved also that the local fluctuation properties of the Gaussian ensembles are stationary over the spectrum.

FUSION ENERGY

PLASMA RESEARCH

REFER ALSO TO CITATION(S) 52303

52336 Electron-beam propagation in plasma channels. Freeman, J.R.; Poukey, J.W. (Sandia Laboratories, Albuquerque, New Mexico 87185). *J. Appl. Phys.;* **50**: No. 9, 5691-5693(Sep 1979).

Electron beams propagating in current-carrying plasma channels proposed for ICF reactors generate an electric field which drives a return current. This electric field reduces the electron energy and also causes an expansion of the trajectory envelope. The scaling of this effect is discussed and estimates of its importance for reactor-level conditions are presented.

PLASMA CONFINEMENT AND HEATING

REFER ALSO TO CITATION(S) 52382

52337 (ORNL/TM—6845) **NFREYA: a Monte Carlo beam deposition code for noncircular tokamak plasmas.** Fowler, R.H.; Holmes, J.A.; Rome, J.A. (Oak Ridge National Lab., TN (USA)). Jul 1979. Contract W-7405-ENG-26. 31p. P 03/MF A01.

A computer code is described which calculates the initial fast ion deposition for neutral beam injection into noncircular tokamak plasmas. The beam deposition is calculated by Monte Carlo techniques as a function of the poloidal flux function psi. The flux function and plasma parameters are obtained from the numerical solution of the axisymmetric MHD equilibrium equation. Bounce averages are performed over the initial ion orbits, and the deposition is weighted by the fraction of time the ion spends in each interval of the psi grid. The divergence, focusing, and shape of the neutral beam

are modeled. The beam geometry part of this problem was solved by G. G. Lister, D. E. Post, and R. Goldston of the Princeton Plasma Physics Laboratory in a code called FREYA. The code described here is a modification of FREYA. Comparisons of the beam depositions calculated with bounce averaging are made with the ion birth depositions for the PDX and ISX-B tokamaks.

52338 Wave-plasma coupling at the lower hybrid frequency. Chan, V.S.; Chiu, S.C. (General Atomic Company, San Diego, California 92138). *Phys. Fluids;* **22**: No. 9, 1724-1731(Sep 1979).

The problem of steady-state nonlinear wave-plasma coupling at the lower hybrid frequency is considered. A nonlinear equation for the electric field in the low-density region at the plasma surface is derived self-consistently. Analytical and numerical solutions for different plasma models show a decrease in coupling efficiency with increasing power level. This result is interpreted using a simple physical picture. Its relevance to experiments is discussed.

52339 Lower hybrid wave scattering by density fluctuations. Ott, E. (University of Maryland, College Park, Maryland 20742). *Phys. Fluids;* **22**: No. 9, 1732-1736(Sep 1979).

A wave kinetic equation is formulated for lower hybrid scattering by low frequency density fluctuations (such as those recently observed in tokamaks). Implications for heating of tokamak plasmas are discussed.

52340 Lower-hybrid-wave heating in the Alcator-A tokamak. Schuss, J.J.; Fairfax, S.; Kusse, B.; Parker, R.R.; Porkolab, M.; Gwinn, D.; Hutchinson, I.; Marmar, E.S.; Overskei, D.; Pappas, D.; Scaturro, L.S.; Wolfe, S. (Francis Bitter Magnet Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Phys. Rev. Lett.;* **43**: No. 4, 274-278(23 Jul 1979).

We report the results of injecting 90 kW of microwave power near the lower hybrid frequency into the Alcator-A tokamak through a two-waveguide array. The observed plasma heating is in disagreement with that expected from linear waveguide-plasma coupling theory. From these results and auxiliary rf probe measurements we infer the nonlinear formation of a high-k/sub parallel/ wave power spectrum at the plasma edge.

PLASMA DIAGNOSTICS

REFER ALSO TO CITATION(S) 52304

PLASMA KINETICS - THEORETICAL

52341 (AD-A—060378) **Stability properties of a cylindrical rotating p-layer immersed in a uniform background plasma.** Uhm, H.S.; Davidson, R.C. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). 1978. Contract N00014-75-C-0309. 34p. Y A03/MF A01.

The electrostatic stability properties of a rotating, charge-neutralized P-layer are investigated within the framework of a hybrid (Vlasov-fluid) model in which the layer ions are described by the Vlasov equation, and the layer electrons and the uniform background plasma are described as macroscopic, cold fluids. It is assumed that the P-layer is thin, with radial thickness (2a) much smaller than the mean radius (R sub 0), and that nu $<<$ 1, where nu is Budker's parameter for the layer ions. Electrostatic stability properties are calculated for perturbations about a weakly diamagnetic P-layer with rectangular density profile. The stability analysis is carried out including the effects of a uniform background plasma, and weak self magnetic fields. Although a slow rotational P-layer (P sub 0 $>$ 0) is found to be stable, it is shown that a fast rotational P-layer (P sub 0 $<$ 0) is unstable for sufficiently high background plasma density ((omega sub p) squared $>>$ (omega sub ci) squared). The typical instability growth rate is a substantial fraction of the ion cyclotron frequency.

52342 (AD-A—060835) **Linear stability of self-similar flow. 4. Convective instability of a spherical cloud expanding into vacuum. Interim report.** Book, D.L. (Naval Research Lab., Washington, DC (USA)). 25 Oct 1978. 18p. Y A02/MF A01.

The well-known class of self-similar solutions for an ideal polytropic gas sphere of radius R(t) expanding into a vacuum with velocity u(r,t) = r R-dot/R is shown to be convectively unstable. The physical mechanism results from the buoyancy force experienced by anisentropic distributions in the inertial gravitational field. An equation for the perturbed displacement, derived from the linearized fluid equations in Lagrangian coordinates, is solved by separation of variables. Because the basic state is nonsteady, the perturbations do not grow exponentially, but can be expressed in terms of hypergeometric functions.

52343 (UCID—18227) **Surface motion and confinement potential for a microwave confined corona.** Ensley, D.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jul 1979. Contract W-7405-ENG-48. 18p. P 02/MF A01.

Approximate time dependent solutions for surface velocities and potentials are given for a plane polarized microwave field confining a hot, over-dense plasma corona. Steady state solutions to Poissons' equation can be applied to the time dependent case, provided transit time effects are included. The product of ion pressure and potential wave (surface) velocity gives an average heating rate $\sim 7/32\ NKT_0V/\text{sub}\ \theta/$ directly to the ions.

52344 (UCID—18228) **Equilibrium plasma corona surfaces.** Ensley, D.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jul 1979. Contract W-7405-ENG-48. 12p. P 02/MF A01.

The distribution of charge of one sign when the opposite charge density is given is determined. Poisson's equation is solved in plane geometry for a simple specified ion density. This automatically gives the inverse solution for a given electron density, by reversing the sign of the potential. Some solutions can approximate a microwave confined corona, for very over dense cases.

52345 Pseudo-classical transport I: The particle and energy flux. Nevins, W.M. (Electronics Research Laboratory, University of California, Berkeley, California 94720). *Phys. Fluids;* **22**: No. 9, 1667-1680(Sep 1979).

The transport of particles and energy that accompanies the trapping of electrons by a finite amplitude drift wave is calculated. Starting from the drift kinetic equation, it is shown that, in the limit of small collision frequency, the electron entropy source is stationary with respect to variations in the electron distribution function. This variational principal is employed, together with the full Fokker—Planck collision operators, to evaluate the electron transport coefficients and, hence, the flux of particles and energy across the magnetic field. Explicit expressions for the particle and energy flux are obtained in terms of the parameters of the plasma-wave system. These expressions should be used in place of the usual quasi-linear expressions for the particle and energy flux when the autocorrelation time of the wave spectrum is sufficient to permit the trapping of electrons by individual waves. These pseudo-classical transport rates are found to be smaller than the quasi-linear expressions that they replace.

52346 Pseudo-classical transport II: A nonlinear theory of the "collisionless" drift instability. Nevins, W.M. (Electronics Research Laboratory, University of California, Berkeley, California 94720). *Phys. Fluids;* **22**: No. 9, 1681-1688(Sep 1979).

A self-consistent theory of the evolution of a plasma slab supporting a finite amplitude drift wave that has trapped the resonant electrons is presented. Previous work is extended to include the effect of particle trapping on the evolution of the finite amplitude wave. The connection between this theory and other works, using quasi-linear theory, on the anomalous transport associated with low frequency drift waves is considered. It is shown that, for parameters typical of tokamak plasmas, particle trapping may result in the nonlinear stabilization of the wave at amplitudes, $(e\text{Phi}_0/T) \simeq 10^{-3}$, that are of the same order as those observed in experiments. The application of this work to experiments is discussed, and it is found to be potentially useful in understanding the drift wave spectrum and transport rates observed in computer simulations, stellarators, and future tokamak experiments.

52347 Unstable continuous spectrum in magnetohydrodynamics. Hameiri, E.; Hammer, J.H. (New York University, Courant Institute of Mathematical Sciences, New York, New York 10012). *Phys. Fluids;* **22**: No. 9, 1700-1706(Sep 1979).

The continuous spectrum need not be stable for an equilibrium with flow. The case of a noncircular, rotating θ pinch is shown to have an unstable continuum with the instability interpreted as a parametric instability arising from coupling between the rotation frequency and the plasma wave frequencies. On the other hand, equilibria with sub-Alfvenic flow parallel to the magnetic field in incompressible plasmas, as well as static equilibria, have a stable continuum. A formulation to determine the continuous spectrum is given in terms of characteristic surfaces for the equations and does not involve the use of any particular system of coordinates.

52348 Addendum to impurity radiation from medium density plasmas. Hopkins, G.R.; Rawls, J.M. (General Atomic Co., San Diego, CA). *Nucl. Technol.;* **43**: No. 3, 382-387(May 1979).

A previous treatment of impurity radiation due to plasma contaminants is extended to include low-Z materials of the type anticipated for first walls in tokamak reactor designs. In addition, analytic fits are presented for the temperature dependence of the key quantities that enter into the modeling of tokamak impurity phenomena.

PLASMA INSTABILITIES

REFER ALSO TO CITATION(S) 52346, 52380

52349 Numerical study of drift-Alfven waves in a sheared magnetic field. Tsang, K.T.; Whitson, J.C.; Smith, J. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Phys. Fluids;* **22**: No. 9, 1689-1699(Sep 1979).

The coupled radial eigenmode equations for electromagnetic drift waves in a sheared magnetic field are solved numerically. In addition to the familiar drift eigenmodes, a different set of eigenmodes was found which is the analog of the sheared Alfven waves of local theory in a sheared magnetic field. The drift mode is mainly electrostatic, and the shear Alfven mode is mainly electromagnetic and closely related to the high-order tearing modes.

52350 Stability of Bernstein—Greene—Kruskal equilibria. Schwarzmeier, J.L.; Lewis, H.R.; Abraham-Shrauner, B.; Symon, K.R. (University of Wisconsin-Madison, Department of Physics, Madison, Wisconsin 53706). *Phys. Fluids;* **22**: No. 9, 1747-1760(Sep 1979).

The recent linear stability analysis of Lewis and Symon for spatially inhomogeneous Vlasov equilibria is illustrated with the case of an unstable periodic wavetrain of strongly inhomogeneous Bernstein—Greene—Kruskal equilibria. The stability formalism involves expanding an auxiliary function related to the perturbation distribution function in terms of the equilibrium Liouville eigenfunctions, and expanding the perturbation potential in terms of the eigenfunctions of an appropriately chosen field operator. The infinite-dimensional dispersion matrix is truncated to M x M by assuming that the normal mode of interest of the perturbation potential can be adequately represented by M eigenfunctions of the field operator; the eigenfrequencies ω are the zeroes of the determinant of the dispersion matrix. A particular Bernstein—Greene—Kruskal equilibrium was chosen as a numerical example, and the growth rate and normal mode of the instability were determined by numerical simulation. The agreement of the theory with the simulation for the growth rate and normal mode of the instability was excellent, and it was possible to choose a field operator a priori such that a 1 x 1 dispersion matrix was sufficient for obtaining accurate results.

52351 Oscillating two-stream instability of ion cyclotron waves. Tripathi, V.K.; Liu, C.S. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). *Phys. Fluids;* **22**: No. 9, 1761-1763(Sep 1979).

It is shown that a high power electrostatic pump around ion cyclotron frequency is unstable for a purely growing short wavelength ($k >> k_0$) perturbation, viz., oscillating two-stream instability. For typical PLT parameters, the instability is excited when the electric field amplitude E_0 exceeds 0.2 esu (i.e., the power $>$ or $\approx$200 kW). When the pump is a Bernstein eigenmode ($\omega_0 <$ or $\approx \omega/$sub c/i, k/sub 0z/v/sub e/$< \omega_0$), the instability occurs over a wide range of k values and the growth rate is large (of the order of 10^{-4} sec^{-1}). For $\omega_0 >$ or $\approx \omega/$sub c/i, the instability has a large growth rate only when the frequency shift is large, i.e., the pump is not an eigenmode. In the case of an ion cyclotron eigenmode, the instability occurs only for restricted k values and pump powers.

52352 Electrostatic ion cyclotron electron drift instability. Gary, S.P.; Gerwin, R.A. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). *Phys. Fluids;* **22**: No. 9, 1764-1769(Sep 1979).

The ion cyclotron electron drift instability is studied using the linear Vlasov dispersion relation for electrostatic instabilities. The sources of free energy are density, temperature and magnetic field gradients across and a current parallel to a unidirectional magnetic field. Propagation is in the plane defined by the drift velocity and the magnetic field. This instability, which is driven by the electron drifts and undergoes ion cyclotron damping, propagates at the ion cyclotron frequency, but at wavelengths much shorter than the ion gyroradius. Although its growth rates are small compared with an ion gyrofrequency, the instability is favored by increasing T/sub e// T/sub i/, and it becomes competetive with the ion cyclotron ion drift instability at T/sub e/$>$ or $=$4T/sub i/.

52353 Kink instabilities of a field reversed ion ring with a toroidal magnetic field. Finn, J.M. (Laboratory of Plasma Studies, Cornell University, Ithaca, New York 14853). *Phys. Fluids;* **22**: No. 9, 1770-1781(Sep 1979).

The low frequency magnetohydrodynamic stability of axisymmetric ion rings in a current-carrying background plasma with a toroidal magnetic field is studied. An energy principle which treats the background plasma by fluid equations and the beam by kinetic theory is employed. The major effects upon stability are the magnetohydrodynamic response of the plasma and beam, a collective reaction of the beam, and betatron resonances. It is found that, if the beam and plasma currents are roughly equal, and if the exterior region contains a cold but highly conducting plasma, there is a window of stability for kinks with safety factor q as low as 1/2. The results also explain the anomalous trapped current losses in the RECE—Christa electron ring experiment.

52354 Stability properties of collisionless universal drift modes in sheared slab geometry. Antonsen, T.M. Jr.; Mahajan, S.M. (Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Phys. Fluids;* **22**: No. 9, 1836-1838(Sep 1979).

Several properties of collisionless drift modes are discussed. The effects of electron temperature gradients, non-Maxwellian electron velocity distributions, model dissipative effects, and the existence of marginally stable eigenmodes in the absence of dissipation are examined.

PLASMA WAVE PHENOMENA

REFER ALSO TO CITATION(S) 52336, 52338, 52339

52355 Velocity Fourier transform solution of a model collision operator. Catto, P.J. (Science Applications, Inc., Boulder, Colorado 80302). *Phys. Fluids;* **22**: No. 9, 1647-1649(Sep 1979).

A model collision operator similar to the one first introduced by Chandrasekar is employed to obtain a kinetic equation for waves in a magnetized plasma that can be solved via a velocity Fourier transform technique.

52356 Energy of waves in a plasma. Auerbach, S.P. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Phys. Fluids;* **22**: No. 9, 1650-1656(Sep 1979).

A formula is given for the energy of an arbitrary electrostatic or electromagnetic wave in a plasma which may be magnetized or unmagnetized, collisional or collisionless, and homogeneous or weakly inhomogeneous. The formula relates the energy of the wave to the magnitude of the electric and magnetic fields of the wave and derivatives of the frequency of the wave with respect to wavenumber and plasma parameters. This formula makes it possible to determine the energy of wave from its dispersion relation (and the magnitude of the fields). The derivation rests on a simple invariance property, related to dimensional analysis, of the Fokker—Planck equation, together with well-known results from the theory of dispersive media.

52357 Numerical studies of current generation by radio-frequency traveling waves. Karney, C.F.F.; Fisch, N.J. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Phys. Fluids;* **22**: No. 9, 1817-1824(Sep 1979).

By injecting radio-frequency traveling waves into a tokamak, continuous toroidal electron currents may be generated. This process is studied by numerically solving the two-dimensional Fokker—Planck equation with an added quasi-linear term. The results are compared with the one-dimensional analytic treatment of Fisch, which predicted a reduced plasma resistivity when high-phase-velocity waves are employed. It is shown that two-dimensional velocity space effects, while retaining the predicted scaling, further reduce the ratio of power dissipated to current generated by about 40%. These effects enhance the attractiveness of steady-state tokamak reactors utilizing this method of current generation.

52358 Unstable drift waves in a sheared magnetic field. Lee, W.W.; Nevins, W.M.; Okuda, H.; White, R.B. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Phys. Rev. Lett.;* **43**: No. 5, 347-350(30 Jul 1979).

Electrostatic collisionless drift waves in a sheared magnetic field have been studied extensively with use of particle-code simulations. When the shear is strong, we have found that the plasma is dominated by spatially uncorrelated small-amplitude oscillations with frequencies close to those prescribed by the local dispersion relation. With a weaker shear, spatially correlated large-amplitude waves with a well-defined frequency have been observed. Theoretically predicted eigenmodes are not the dominant feature of the fluctuation spectrum.

FUSION POWER PLANT TECHNOLOGY

52359 (AD-A—060588) **A conceptual design for an imploding-liner fusion reactor (LINUS). Interim report.** Robson, A.E. (Naval Research Lab., Washington, DC (USA)). Sep 1978. 55p. Y A04/MF A01.

This report describes the conceptual design of a fusion reactor based on the dynamic compression of a magnetically-confined DT plasma by an imploding liquid lead-lithium liner. Stable implosion-expansion cycles are achieved by rotating the liner, and imploding it by a means of a rigid mechanism driven by high pressure helium (the 'captive liner' principle). At peak compression the magnetic field is 0.5 MG and the liner is 1 m thick, which is enough to absorb the fusion neutrons. The energy of the trapped alpha-particles is directly recovered in the expansion and compensates for the resistive and mechanical losses in the liner, making the mechanical cycle self-sustaining. The reactor works rather like an internal combustion engine, except that there is no shaft output: all the nuclear energy appears in the liner as heat. The initial plasma is created by

means of a pulsed rotating relativistic electron beam injected from one end. The beam sets up both the plasma and the confining magnetic field, and no external magnet coils are required. The reactor is repetitively cycled at 1.67 Hz for a gross electrical power output of 1000 MW.

52360 (ANL/FPP—78-4) **Fusion Power Program. Quarterly progress report, October—December 1978.** (Argonne National Lab., IL (USA)). Apr 1979. Contract W-31-109-ENG-38. 94p. P 05/MF A01.

This quarterly report summarizes the Argonne National Laboratory work performed for the Office of Fusion Energy during the October—December 1978 quarter in the following research and development areas: materials; energy storage and transfer; tritium containment, recovery and control; advanced reactor design; atomic data; reactor safety; fusion-fission hybrid systems; alternate applications of fusion energy; and other work related to fusion power. Three separate abstracts were prepared for the included sections. (MOW)

52361 (ANL/FPP—78-4, pp 58-75) **Fusion energy applications.** Apr 1979.

In Fusion Power Program. Quarterly progress report, October—December 1978.

Research progress is reported for each of the following areas: (1) savings in plasma support systems for a tokamak hybrid reactor, (2) fusion reactor safety studies, (3) energy storage and transfer, (4) test results of the 1.5 MJ pulsed superconducting coil, and (5) atomic data studies. (MOW)

52362 Performance parameters for fusion—fission power systems. Bender, D.J. (Lawrence Livermore Lab., CA). *Nucl. Technol.;* **44**: No. 3, 381-389(Aug 1979).

A fusion—fission power system is considered in which fissile-producing hybrid (or fusion—fission) reactors supply the makeup fuel needs for fissile-consuming, or converter, reactors. As a result of the diverse nature of the hybrid reactor, a number of general performance parameters are proposed that will permit comparison of various hybrid reactor configurations. In addition, the relationships developed are used to show that scientific feasibility or breakeven for the hybrid reactor is near at hand in the fusion program and that attractive commercial reactors can be based on near-term plasma physics.

BLANKET ENGINEERING

REFER ALSO TO CITATION(S) 51903, 51931

52363 (ANL/FPP—78-4, pp 37-57) **Fusion systems engineering.** Apr 1979.

In Fusion Power Program. Quarterly progress report, October—December 1978.

Some research progress is reported in each of the following four areas: (1) experimental power reactor studies, (2) blanket and shield engineering, (3) tritium processing and control, and (4) technology development impact on the choice of fusion fuel cycles. (MOW)

52364 (GA-A—15335) **Structural concerns in fusion hybrid reactors.** Schultz, K.R. (General Atomic Co., San Diego, CA (USA)). Jan 1979. Contract EY-76-C-03-0167-038. 13p. (CONF-790802—22). P 02/MF A01.

From International conference on structural mechanics in reactor technology; Berlin, F.R. Germany (13 Aug 1979).

The design environment for the blanket of a fusion hybrid is considered. It is noted that structural concerns play an important role in the trade-off between high performance and design simplicity for hybrid reactor systems and are quite challenging due to the high power densities and temperature gradients that may occur. The fusion—fission reactor concept and its mechanical features are reviewed. Structural concerns are discussed for tokamak, mirror and inertial fusion drivers. Various modes of fusion—fission operation are considered and the design requirements are discussed. The performance characteristics of hybrid blankets are considered.

52365 (UCRL—82663) **Beryllium/molten salt blanket: a new blanket concept.** Lee, J.D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Apr 1979. Contract W-7405-ENG-48. 20p. (CONF-790117—3). P 02/MF A01.

From 3. US/USSR symposium on fusion - fission hybrids; Princeton, NJ, USA (22 Jan 1979).

The Beryllium/Molten Salt (Be/MS) blanket is an interesting contender for fissile breeding fusion reactors. Beryllium is used for neutron multiplication, and a Li and Th containing molten salt is used for on line removal of bred fusile (T) and fissile (U233) fuels. A conceptual Be/MS blanket is described and its neutronic performance is estimated. The Be/MS blanket has unique characteristics that may be advantageous and their potential advantages are presented.

52366 Cyclic purging for low-temperature solid fusion reactor blanket operation. Was, G.S.; Lidsky, L.M. (Massachusetts Inst. of Tech., Cambridge). *Nucl. Technol.;* **43**: No. 3, 289-300(May 1979).

A purging process was developed that will permit operation of fusion reactor blankets employing solid $LiAlO_2$ as the breeder material at fuel temperatures of $<600°C$. The low fuel temperature would greatly reduce the problems of fuel sintering, densification, and volume expansion that occur at fuel temperatures in excess of 900°C without degrading the plant thermal efficiency. The process consists of heating the blanket to a specified temperature for a given time at regular intervals to release tritium held up in the breeding material. As an example, a detailed purging cycle was developed for the breeder rod shim rod blanket that uses $LiAlO_2$ in the form of micronsize particles compacted into millimeter-size pellets and is designed for low-temperature operation. Tritium inventory, doubling time, purging time, purging temperature, purging frequency, and particle size are the parameters used to evaluate the process. Calculations indicate that breeder particle sizes ranging from 20 to 50 μm and purging temperatures ranging from 600 to 700°C can result in purge times of <1 h with three or more weeks between purges, and a doubling time of 7 yr for a blanket inventory limit of 5 kg and a breeding ratio of <1.02.

MAGNET COILS AND FIELDS

52367 (GA-A—15475) **Design of aluminum stabilized superconductor for tokamak toroidal field coils.** Chen, W.Y.; Alcorn, J.S.; Purcell, J.R. (General Atomic Co., San Diego, CA (USA)). Jun 1979. Contract AT03-76ET51011. 17p. (CONF-790815—5). P 02/MF A01.

From Cryogenic engineering conference; Madison, WI, USA (21 Aug 1979).

A design study on an Al-stabilized 10-12T tokamak toroidal field-coil cooled with pool boiling LHe is presented. Relevant factors considered include the mechanical properties of pure aluminium, the degradation in resistivity due to neutron irradiation, the selection and cofiguration of the reinforcement materials, and the overall stability of the conductor. Both alloy Al and stainless steel have been considered as the reinforcement material. The dimensions and parameters of the conductor for each field region and the resulting TF-coils are summarized and compared with a copper design.

POWER SUPPLIES, ENERGY STORAGE

52368 (DOE/ET—0103) **Electrical problems committee report.** (Department of Energy, Washington, DC (USA)). Jun 1979. 78p. P 05/MF A01.

This document is the report of the committee appointed to review the experience of the MFE Program with electrical equipment and to suggest actions to minimize future problems. The committee observed that the electrical problems that have occurred could be traced not to misapplication of project and engineering technical principles, but to lack of application of project and engineering management principles. The report is structured so that the first four sections: Introduction, Findings, Recommendations, and Immediate Recommended Actions, can be used as an executive summary. The discussion section and attachments contain further detail.

52369 (SAND—79-0932C) **Self-magnetically insulated power flow.** VanDevender, J.P. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 6p. (CONF-790622—6). P 02/MF A01.

From Pulsed power conference; Lubbock, TX, USA (12 Jun 1979).

Portions of document are illegible.

Electromagnetic power transport through self-magnetically insulated vacuum transmission lines has been developed into a useful and reliable technology. A power density of 160 TW/m^2 has been transported at ~ 100 percent efficiency over six meters. The theoretical understanding of power flow through lines of constant cross section has progressed through analytical theory and 2-D electromagnetic particle simulations. However, work needs to be done on the effects of line transitions in which the cross section changes in the direction of power flow. The major features of our present understanding will be reviewed and some promising hypotheses now under investigation will be presented.

52370 (SAND—79-1084C) **Small helical flux compression amplifiers.** Gover, J.E.; Stuetzer, O.M.; Johnson, J.L. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 33p. (CONF-790540—2). P 03/MF A01.

From 2. international conference on megagauss magnetic field generation and related topics; Washington, DC, USA (29 May 1979).

Small, explosively compressed, magnetic flux transducers with many closely spaced helical turns are investigated theoretically and experimentally. The analysis is limited to linear operation, but

takes into account load influence, proximity effects, and switching delays. The latter are due to retarded breakdown in the wire insulation and to the finite decay time of the magnetic field in the wire. More than 150 experiments showed considerable data scatter. Shots which exhibited low clocking and high amplification were in good agreement with the theory. The main conclusion is that device performance is limited not only by flux loss, but by flux remaining in the generator after compression.

52371 (SAND—79-1234C) **Magnet optimization for pulsed energy conversion.** Tucker, W.K.; Cnare, E.C.; Brooks, W.P.; Wilcox, R.E.; Markiewicz, W.D. (Sandia Labs., Albuquerque, NM (USA); Intermagnetics General Corp., Guilderland, NY (USA)). 1979. Contract EY-76-C-04-0789. 4p. (CONF-790622—25). P 02/MF A01.

From Pulsed power conference; Lubbock, TX, USA (12 Jun 1979).

A flux compression generator called PULSAR is being developed to meet power requirements for future fusion reactors. Key components of the generator are superconducting magnet, generator coil of normal metallic conductor, and an armature, either a metallic conductor or plasma. Chemical energy is used to increase the mutual inductance between the armture and nested generator coil and superconducting magnet. Flux compression occurs and electrical energy is transferred to a load inductance. This paper will present the results of a study that was conducted to design a suitable superconducting magnet for the PULSAR device.

COOLING SYSTEMS

REFER ALSO TO CITATION(S) 52363

HEATING AND FUELING SYSTEMS

52372 **Neutral beam sciopticon.** Ryan, P.M.; Whealton, J.H.; Davis, R.C.; Stirling, W.L.; Tsai, C.C. (Oak Ridge National Laboratory, Oak Ridge, Tennesse 37830). *Rev. Sci. Instrum.;* **50**: No. 9, 1160(Sep 1979).

A sciopticon based on the pinhole-camera effect is being used to determine individual beamlet contributions to the quality of neutral beams extracted from multiaperture ion sources. The technique outlined in this note can be used to study the effects on beam optics of nonhomogeneous source plasma density or acceleration gap nonuniformities, grid nonparallelism or aperture misplacement, and space-charge blowup or scattering in the neutralizer cell.

52373 **Convective helium cooling of grids in continuously operated neutral beam injectors.** Hoffman, M.A. (Lawrence Livermore Lab., CA). *Nucl. Technol.;* **44**: No. 3, 346-356(Aug 1979).

The grid wires in the accelerator region of neutral beam injectors can be subjected to high heat fluxes from charge-exchange ion impingement, electron impingement, and radiation. Since the actual values for these heat fluxes are not yet well known, it is useful to determine the limits on the allowable heat flux for various grid cooling schemes. The first example chosen for this parametric study is the potentially interesting case of helium-cooled TZM grid tubes. The results indicate that sputtering and thermal deflections are the two most severe limits on the heat flux that can be tolerated by the grids.

52374 **D—D neutron and x-ray yields from high-power deuterium beam injectors.** Kim, J. (Oak Ridge National Lab., TN). *Nucl. Technol.;* **44**: No. 2, 314-321(Jul 1979).

Calculations are made of 2.5-MeV neutron yields via D—D reactions from various beam line components, including beam targets and a neutralizer gas cell, and of x-ray generation from accelerator columns in deuterium beam injectors of various energies from 40 to 200 keV, with accelerator powers ranging from 2 to 20 MW per beam line. The calculated neutron intensities from the neutral beam injector systems for present and future fusion research are in the range between 10^{11} and 10^{13} n/s and warrant biological shielding in most cases, even for low duty cycle operation. X radiation from the accelerator columns becomes a health physics concern only for injectors with energy higher than $\sim$ 100 keV.

TRITIUM PROCESSING, ENVIRONMENT AND SAFETY

52375 (LA-UR—79-393) **Tritium system test assembly control system cost estimate.** Stutz, R.A. (Los Alamos Scientific Lab., NM (USA)). 1979. Contract W-7405-ENG-36. 17p. (CONF-790715—1). P 02/MF A01.

From 23. annual meeting of the American Association of Cost Engineers; Cincinnati, OH, USA (15 Jul 1979).

The principal objectives of the Tritium Systems Test Assembly (TSTA), which includes the development, demonstration and interfacing of technologies related to the deuterium—tritium fuel cycle for fusion reactor systems, are concisely stated. The various integrated subsystems comprising TSTA and their functions are discussed. Each of the four major subdivisions of TSTA, including the main process system, the environmental and safety systems, supporting systems and the physical plant are briefly discussed. An overview of the Master Data Acquisition and Control System, which will control all functional operation of TSTA, is provided.

INERTIAL CONFINEMENT TECHNOLOGY

REFER ALSO TO CITATION(S) 52369, 52370, 52392

52376 (LBL—9332) **Development of heavy-ion accelerators as drivers for inertially confined fusion.** Herrmannsfeldt, W.B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1979. Contract W-7405-ENG-48. 116p. (SLAC—221). P 06/MF A01.

The commercialization of inertial confinement fusion is discussed in terms of power costs. A chapter on heavy ion accelerators covers the prinicpal components, beam loss mechanisms, and theoretical considerations. Other tyopics discussed include the following: (1) heavy ion fusion implementation plan, (2) driver with accumulator rings fed by an rf LINAC, (3) single pass driver with an induction LINAC, and (4) implementation scenarios.

52377 (SAND—79-0819C) **Progress toward fusion with particle beams.** Kuswa, G.W.; Bieg, K.W.; Burns, E.J.T. (Sandia Labs., Albuquerque, NM (USA)). 1979. Contract EY-76-C-04-0789. 13p. (CONF-790723—5). P 02/MF A01.

From 3. international topical conference on high power electron and ion beam research and technology; Novosibirsk, USSR (3 Jul 1979).

This report discusses ion beam diodes which use insulating magnetic fields produced by coil systems. The development of ion diodes to produce light ion beams for fusion pellet ignition is briefly reviewed. The major goals for the light ion effort, which include the development of an ion diode to provide several TW/cm^2, are discussed. The necessity to design ion sources which provide a prompt and uniform plasma layer when the diode voltage uses, in order to minimize electron loss and anode damage, is noted. Results of a number of materials and configurations tested for ion sources are reported. Numerical calculations are performed to investigate diode behavior. Future work on diodes with extracted beams is mentioned.

52378 (SAND—79-1129) **Computations of the spherical e $\rightarrow$ i convertor.** Poukey, J.W. (Sandia Labs., Albuquerque, NM (USA)). May 1979. Contract EY-76-C-04-0789. 24p. P 02/MF A01.

One proposed approach to the overlap/deposition problem for multi-channel electron beams is to place a thin hollow sphere in the overlap region and allow the incoming electrons to form a virtual cathode inside this sphere. The resulting electric field causes ions from the inner surface of the sphere to flow inward radially towards a target. The efficiency of this process is studied analytically and with a 1-D spherical, two-species electrostatic particle code. The maximum possible (power conversion) efficiency is concluded to be about 10 percent. Two-dimensional effects are briefly considered, and angular momentum in particular is found to be a possibly serious limitation.

52379 (SAND—79-7044) **Technical review of the Sandia Laboratories' Particle Beam Fusion Program.** (Science Applications, Inc., Albuquerque, NM (USA)). 18 May 1979. Contract EY-76-C-04-0789. 38p. P 03/MF A01.

This report considers the technical aspects of Sandia Laboratories' Particle Beam Fusion Program and examines the program's initial goals, the progress made to date towards reaching those goals, and the future plans or methods of reaching those original or modified goals. A summary of Sandia Laboratories' effort, which seeks to demonstrate that high voltage pulsed power generated high-current electron or light ion beams can be used to ignite a deuterium or tritium pellet, is provided. A brief review and assessment of the Sandia Pulse Power Program is given. Several critical issues and summaries of the committee members' opinions are discussed.

52380 **Decay instability of laser radiation in a magnetoplasma.** Tripathi, V.K.; Sharma, R.R. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). *Phys. Fluids;* **22**: No. 9, 1799-1803(Sep 1979).

The self-generated mega-Gauss magnetic fields in laser pellet fusion plasmas open some potential channels of parametric decay of laser radiation. In the vicinity of the cutoff, the pump decays efficiently into (i) lower hybrid and upper hybrid modes, (ii) ion acoustic and upper hybrid modes, (iii) fast ion wave and plasma wave, and (iv) Bernstein mode and plasma wave. At higher pump powers, nonlinear Landau damping and cyclotron damping by electrons possess large growth rates. These instabilities are also relevant to tokamak-type plasmas where nonlinear effects are important in the vicinity of the upper hybrid resonance.

52381 **Analytic ion self-pinch formulae.** Wright, T.P. (Sandia Laboratories, Albuquerque, New Mexico 87185). *Phys. Fluids;* **22**: No. 9, 1831-1832(Sep 1979).

Expressions are derived for the distance over which an ion beam will pinch to its first node for four cases: A: axially injected solid cylindrical beam; B: solid beam with geometric focus; C: hollow cylindrical beam; D: converging disk beam.

52382 Long-pulse laser-plasma interactions at 10^{13}—10^{15} W/cm². Ripin, B.H.; Whitlock, R.R.; Young, F.C.; Obenschain, S.P.; McLean, E.A.; Decoste, R. (Naval Research Laboratory, Washington, D. C. 20375). *Phys. Rev. Lett.;* **43**: No. 5, 350-353(30 Jul 1979).

Laser-plasma interaction physics including absorption, plasma formation, heating, plasma expansion, and energy transport, are examined for 3-nsec Nd-laser irradiances between 10^{12} and 10^{15} W/cm². Efficient energy deposition and conditions favorable to ablative acceleration are found at 10^{13}—10^{15} W/cm², whereas reduced absorption, hot electrons, and fast ions are seen at 7×10^{14} W/cm². Suitability of the observed physics to pellet fusion is discussed.

52383 Observation of magnetically enhanced electron-beam—energy deposition. Widner, M.M.; Goldstein, S.A.; Mendel, C.W. Jr.; Burns, E.J.T.; Quintenz, J.P.; Farnsworth, A.V. Jr. (Sandia Laboratories, Albuquerque, New Mexico 87185). *Phys. Rev. Lett.;* **43**: No. 5, 357-360(30 Jul 1979).

Electron-energy deposition in thin Au foils irradiated by a tightly pinched electron beam has been studied on the Proto I accelerator (1.1 MV, 300 kA, 25 nsec). X-ray diode measurements indicate front surface temperatures of 15—20 eV, in agreement with calculations assuming deposition rates of $>$ or $\approx 5 \times 10^{13}$ W/g. These results are consistent with magnetically enhanced deposition due to self-beam fields (enhancement $\sim$ 3—5).

52384 Enhancement of laser pulse contrast ratios via transient response of narrow band resonant interferometers. Fisher, R.A.; Feldman, B. (to Dept. of Energy). US Patent Application 942,227. 14 Sep 1978. 7p.

The present invention utilizes the distinction between the narrow bandwidth unwanted fed-through background signal and the broad-band short duration desired signal. In one embodiment, a resonantly tuned Fabry-Perot interferometer will act as a pulse duration discriminator because it will transmit the undesired feed-through while reflecting the desired signal with little modification.

52385 Chemistry in lasers. XIV. Utilization of noble gas hydride lasers in the dissipative confinement of two-step nuclear fusion of doubly isotopic boron hydrides. Keszthelyi, C.P. (Univ. of Colorado, Boulder). *Acta Phys. Chem.;* **23**: No. 4, 413-417(1977).

The article is a continuation of the non-classical aspects of fusion. The utilization of doubly isotopic boron hydrides (H—2 and H—3 combined with B—11) in a two-step dissipatively controlled nuclear fusion process is proposed for energy generation, with tandem laser/e-beam pumping. To broaden the optical excitation capability, noble gas hydrides are shown to have principal advantages: lack of a bound ground electronic state (comparable with excimers), far less corrosiveness than noble gas halides (or fluorine containing laser media), wide range of tunability including the soft X-ray/vuv region, and lack of decomposition of the compounds involved upon prolonged usage (superior to dyes).

COMPONENT DEVELOPMENT AND MATERIALS TESTING

REFER ALSO TO CITATION(S) 51901, 51933, 51942, 51944, 51945, 51961, 51962, 51973, 51974, 51975, 51976, 52304

52386 (ANL/FPP—78-4, pp 1-36) **Fusion Reactor Materials.** Apr 1979.

In Fusion Power Program. Quarterly progress report, October—December 1978.

Data are presented for each of the following research areas: (1) effects of irradiation of fusion reactor materials, (2) hydrogen permeation and fusion materials behavior, (3) surface damage and sputtering of ATJ graphite by D^+, (4) surface damage of TiB_2 coatings under D^+ and $^4He^+$ irradiation, (5) neutral and ionic sputtering yields for D and O on titanium, and (6) damage analysis and dosimetry. (MOW)

52387 (DOE/ET—0058/5) **Alloy development for irradiation performance. Quarterly progress report for period ending March 31, 1979.** Peterson, S. (comp.). (Oak Ridge National Lab., TN (USA)). 1979. Contract W-7405-ENG-26. 171p. P 08/MF A01.

Separate abstracts were prepared for 13 of the included sections. (MOW)

52388 (DOE/ET—0058/5, pp 2-5) **Application of magnetic stainless steels to tokamak reactor design.** Harkness, S.D.; Evans, K.; Turner, L. (Argonne National Lab., IL). 1979.

In Alloy development for irradiation performance. Quarterly progress report for period ending March 31, 1979.

A review of the effect of the use of magnetic structure on MHD equilibria, pulsed field penetration, and structural design has revealed no significant difficulties as long as the material is saturated by the toroidal field. It therefore appears possible for tokamak reactor designers to consider the application of this swelling resistant material in future designs.

52389 (DOE/ET—0058/5, pp 6-17) **Ferritic stainless steels for fusion applications.** Rosenwasser, S.N.; Miller, P.; Dalessandro, J.A.; Rawls, J.M. (General Atomic Co., San Diego, CA). 1979.

In Alloy development for irradiation performance. Quarterly progress report for period ending March 31, 1979.

An assessment was made of the feasibility and design impact of using a ferromagnetic martensitic stainless steel such as HT9 in first wall/blanket structures. The results of this preliminary evaluation suggested that use of Fe—Cr martensitic stainless steels in fusion first-wall/blanket structures might result in significantly increased component lifetimes relative to 20%-cold-worked type 316 stainless steel, particularly up to operating temperatures of about 520°C. Measurements of some pertinent magnetic properties and the results of rough calculations indicated that the effects of ferromagnetic walls on the static and dynamic fields required for plasma confinement are relatively minor and could be accommodated by proper reactor design.

52390 (DOE/ET—0058/5, pp 20-22) **Design of materials irradiation experiments in the ORR utilizing spectral tailoring and reencapsulation.** Gabriel, T.A.; Thoms, K.R.; Grossbeck, M.L. (Oak Ridge National Lab., TN). 1979.

In Alloy development for irradiation performance. Quarterly progress report for period ending March 31, 1979.

An experiment was designed to achieve the proper He/dpa ratio to simulate fusion reactor conditions for Paths A and B alloys with the Oak Ridge Research Reactor. The composition and geometry of the shields (core pieces) to tailor the spectrum as well as to determine the times to change core pieces are now being calculated. The conceptual design is now complete, following a major revision.

52391 (UCRL—81860) **RTNS-II neutron sources: status report.** Davis, J.C.; Heikkinen, D.W.; Held, J.L.; Logan, C.M.; Osher, J.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Mar 1979. Contract W-7405-ENG-48. 4p. (CONF-790327—155). P 02/MF A01.

From IEEE particle accelerator conference; San Francisco, CA, USA (12 Mar 1979).

Experience with neutron sources consisting of air-insulated 400 kV deuteron accelerators and tritium targets which rotate at 5000 rpm is reported. These accelerators are part of the Rotating Target Neutron Source-II (RTNS-II) facility. A review of the accelerator design is given. Operation of the prototype accelerator using hydrogen beams is discussed in detail. The parameters are tabulated for the first accelerator operated as a neutron source in November, 1978. Additional terminal pumping has reduced the radiation level from bremsstrahlung by at least a factor of ten. Ion source performance with deuterium has not been as good as that obtained with hydrogen. Beam divergence at the acceleration column exit is also observed. Future efforts include the fabrication of large diameter targets and design changes to improve source operation.

52392 Effect of liquid-metal protection schemes in inertial confinement fusion reactors. Avci, H.I.; Kulcinski, G.L. (Univ. of Wisconsin, Madison). *Nucl. Technol.;* **44**: No. 3, 333-345(Aug 1979).

The placement of liquid metals (lithium, lead, and a Pb—Li eutectic Pb_6Li) between the first wall and the source of neutrons has been considered as a mechanism for extending first wall lifetimes in inertial confinement fusion reactors. This scheme is called the Internal Spectral Shifter and Energy Converter (ISSEC). All three liquid metals have been shown to reduce the radiation damage in the Type 316 stainless-steel structural first wall and thus increase the first wall lifetime. An overall conclusion of the study is that the Pb—Li eutectic ISSEC has better characteristics than both pure lead and lithium ISSECs, and for best results it should be used at thicknesses ranging from 45 to 65 cm.

52393 Design of a metal-seal valve for high radiation use. Stone, R.R.; Scully, R. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). *J. Vac. Sci. Technol.;* **16**: No. 4, 1049-1050(Jul 1979).

A 457-mm, metal-seal gate valve has recently been developed for the high vacuum, high radiation conditions encountered in the Tokamak Fusion Test Reactor. Air pressure inside an expandable bellows provides the sealing surface by pushing replaceable steel knife edges into an indium ring. The bellows pressure can be increased with every cycle to maintain the seal. After a 2000-cycle test, the valve's leak rate was 1.8 nTorr l s^{-1}.

52394 Feasibility study to produce first wall fusion reactor spectra around a 14-MeV neutron point source. Battat, M.E.; Dierckx, L.A.R.; Emigh, C.R. (Los Alamos Scientific Lab., NM). *Nucl. Technol.;* **43**: No. 3, 338-348(May 1979).

A detailed analysis is made showing the feasibility of producing a neutron spectrum that will closely match the first wall neutron environment of any proposed future fusion reactor. An intense neutron source based on the deuterium—tritium reaction and producing 1 to 3 X 10^{18} 14-MeV neutrons per second in a small volume, <1 cm^3, is used as the primary source. The spectrum is tailored by surrounding this source with a spherical blanket composed of concentric shells of lithium, uranium (93% ^{235}U), and beryllium. The irradiation volume of $\sim$ 100 cm^3 is located between the source and the inside of the blanket and can be used for the purpose of radiation damage evaluations.

52395 **Design calculations for a 14-MeV neutron collimator.** Lillie, R.A.; Alsmiller, R.G. Jr.; Mihalczo, J.T. (Oak Ridge National Lab., TN). *Nucl. Technol.;* **43**: No. 3, 373-381(May 1979).

A number of Type 316 stainless-steel right circular cylindrical shells of varying lengths have been analyzed using two-dimensional discrete-ordinates transport methods together with first- and last-flight particle estimators to aid in the design of neutron collimators for the Tokamak Fusion Test Reactor (TFTR). In the TFTR, the 14-MeV neutron source has a very large spatial extent, and the collimators must be designed to allow spectral measurements that refer to only a small spatial region of this extended source. The analysis identifies the 14-MeV neutrons from scattering in the Type 316 stainless steel immediately adjacent to the collimator opening as the dominant contributor to detector background. Collimator lengths >0.60 m were found sufficient to attenuate uncollided background neutrons for reasonable souce-detector distances. The lower energy (<13.8 MeV) neutron background and gamma background were not found to be significant.

GENERAL AND MISCELLANEOUS

MATHEMATICS AND COMPUTERS

REFER ALSO TO CITATION(S) 50997, 52204

52396 (ANL—79-68) **Production runs on the CRAY-1.** Rudsinski, L.; Pieper, G.W. (Argonne National Lab., IL (USA)). Jul 1979. Contract W-31-109-ENG-38. 21p. P 02/MF A01.

Under a grant from the National Center for Atmospheric Research, users from several Argonne divisions executed programs on the CRAY-1. The objectives were twofold: to determine the feasibility of implementing large codes on the CRAY-1, and to decide what algorithm changes could be made to improve run time on a vector machine. In addition, it was hoped to evaluate the code produced by the new CRAY FORTRAN compiler. Large reactor codes were implemented with relative ease, requiring, for example, approximately two man-weeks to get a 56,000-card program running correctly. Certain difficulties were encountered, however, in transferring the large binary files required by a biomedical code. It is concluded that it is both feasible and desirable to implement large codes on the CRAY-1. Better instruction scheduling in the CRAY compiler reduced run times by 40 percent. With some rewriting in Assembler language to produce optimal code, the programs tested ran two to four times faster than on the IBM 370/195 or the 3033 at Argonne. Further improvement (up to twofold) was realized in several programs by substituting new algorithms to take advantage of the vector architecture of the CRAY. 8 tables.

52397 (ANL—79-69) **Nonlinear ergodic theory in Banach spaces.** Reich, S. (Argonne National Lab., IL (USA)). Jul 1979. Contract W-31-109-ENG-38. 20p. P 02/MF A01.

The author proves the mean ergodic theorem for nonlinear nonexpansive mappings in Banach spaces, extends it by a different argument, deduces several consequences, and points out open problems.

52398 (ANL—7411(Vol.1)(Rev.)) **National Energy Software Center: compilation of program abstracts.** Brown, J.M.; Butler, M.K.; De Bruler, M.M. (Argonne National Lab., IL (USA)). May 1979. Contract W-31-109-ENG-38. 753p. P 99/MF A01.

This is the third complete revision of program abstracts undertaken by the Center. Programs of the IBM 7040, 7090, and CDC 3600 vintage have been removed. Historical data and information on abstract format, program package contents, and subject classification are given. The following subject areas are included in the library: cross section and resonance integral calculations; spectrum calculations, generation of group constants, lattice and cell problems; static design studies; depletion, fuel management, cost analysis, and power plant economics; space-independent kinetics; space—time kinetics, coupled neutronics—hydrodynamics—thermodynamics and excursion simulations; radiological safety, hazard and accident analysis; heat transfer and fluid flow; deformation and stress distribution computations, structural analysis and engineering design studies; gamma heating and shield design; reactor systems analysis; data preparation; data management; subsidiary calculations; experimental data processing; general mathematical and computing system routines; materials; environmental and earth sciences; electronics, engineering equipment, and energy systems studies; chemistry; particle accelerators and high-voltage machines; physics; magnetic fusion research; data. (RWR)

52399 (ANL—7411(Vol.2)(Rev.)) **National Energy Software Center: compilation of program abstracts.** Brown, J.M.; Butler, M.K.; De Bruler, M.M. (Argonne National Lab., IL (USA)). May 1979. Contract W-31-109-ENG-38. 700p. P 99/MF A01.

This volume contains the remaining program abstracts, along with a listing of the library programs by subject classification and a KWIC index. (RWR)

52400 (COO—2383-0059) **Numerical software: science or alchemy.** Gear, C.W. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Jun 1979. Contract EY-76-S-02-2383. 27p. (UIUCDCS-R—79-969; UILU-ENG—79-1715). P 03/MF A01.

This is a summary of the Forsythe lecture presented at the Computer Science Conference, Dayton, Ohio, in February 1979. It examines the activity called Numerical Software, first to see what distinguishes numerical software from any other form of software and why numerical software is so much more difficult. Then it examines the scientific basis of such software and discusses that is lacking in that basis.

52401 (COO—2874-45) **Confidence intervals for the odds ratio in cast-control studies: the state of the art.** Fleiss, J.L. (Columbia Univ., New York (USA). School of Public Health). Apr 1978. Contract EY-76-S-02-2874. 23p. P 02/MF A01.

Many approximate procedures are available for setting confidence limits around the odds ratio in a four-fold table. A number of them are analyzed according to three criteria: close agreement between the actual and the nominal confidence levels; exact agreement with a hypothesis test for or against significance; and relative simplicity in calculation. The procedure due to Cornfield comes closer to satisfying all three criteria than any of the others examined. Formulas are provided for an iterative solution to Cornfield's equations.

52402 (DOE/ER/10355—1) **SIAM 1978 fall meeting and symposium on sparse matrix computations.** (Society for Industrial and Applied Mathematics, Philadelphia, PA (USA)). 1978. Contract EY-76-S-02-2874. 55p. (CONF-781098—(Absts.)). P 04/MF A01.

From Fall SIAM meeting; Knoxville, TN, USA (30 Oct 1978).

The program and abstracts of the SIAM 1978 fall meeting in Knoxville, Tennessee, are given, along with those of the associated symposium on sparse matrix computations. The papers dealt with both pure mathematics and mathematics applied to many different subject areas. (RWR)

52403 (KFK-PDV—159) **Methods for the on-line-optimization of the steady-state-behavior of nonlinear processes with slow dynamics.** Bamberger, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). Aug 1978. 183p. (In German). U 09/MF A01.

Various methods for the on-line optimization of the steady-state behavior of slow dynamic processes in a short time are first tested with several test processes, simulated by analog computer, then with a pilot process. For the practical test, a FORTRAN program package called OLIOPT was developedd for process computers. The on-line optimization in a short time needs a nonlinear dynamic process model which is updated to predict the static behavior during the transient state of the process. By this model the gradients of the performance index (f.e. maximum efficiency or throughput) derived from the process inputs can be computed and inserted in the optimization algorithm.

52404 (LA—7837-MS) **Curious function of Otto Frisch.** Everett, C.J.; Cashwell, E.D. (Los Alamos Scientific Lab., NM (USA)). Jun 1979. Contract W-7405-ENG-36. 11p. P 02/MF A01.

If (x/sub n/) is a countable set of points everywhere dense on (0,1), and (j/sub n/), a set of corresponding positive numbers with Σ_1/sup infinity/ j/sub n/ = J $< \infty$, then a monotone nondecreasing function f(x) on [0,1], with f(0) = 0, f(1) = J, which is continuous on [0,1] except at each x/sub n/, where it is right continuous, but left discontinuous with jump j/sub n/, is necessarily a sum of step functions uniquely determined by the x/sub n/, j/sub n/. A curious function, explicitly defined by O. Frisch, is proved to be such a function, with jump j(p/q) = 1/(2/sup q/ - 1) at each (reduced) rational point p/q on (0,1), and continuous elsewhere. Moreover, it is rational valued iff x is rational, and has some remarkable number theoretic properties, stemming from its character as a sum of step functions.

52405 (ORNL/CSD/TM—64) **Lecture notes on ordinary differential equations software, user's guides for ODE, RKF45, GEAR, and**

EPISODE. Wenzel, J.A.; Funderlic, R.E. (Oak Ridge National Lab., TN (USA)). Aug 1979. Contract W-7405-ENG-26. 89p. P 05/MF A01.

Four software packages for the numerical solution of initial-value problems for systems of ordinary differential equations are demonstrated with sample problems and solutions. These packages are contained in the Core Library of Numerical Software of the Computer Sciences Division, ORNL. 37 figures.

52406 (SLAC—196(Rev.1)) **DPAK and HPAK: a versatile display and histogramming package.** Logg, C.A.; Boyarski, A.M.; Cook, A.J.; Cottrell, R.L.A.; Sund, S. (Stanford Linear Accelerator Center, CA (USA)). Jul 1979. Contract EY-76-C-03-0515. 88p. P 05/MF A01.

The features of a display and histogram package which requires a minimal number of subroutine calls in order to generate graphic output in many flavors on a variety of devices are described. Default options are preset to values that are generally most wanted, but the default values may be readily changed to the user's needs. The description falls naturally into two parts, namely, the set of routines (DPAK) for displaying data on some device, and the set of routines (HPAK) for generating histograms. HPAK provides a means of allocating memory for histograms, accumulating data into histograms, and subsequently displaying the hisotgrams via calls to the DPAK routines. Histograms and displays of either one or two independent variables can be made.

52407 (SLAC-PUB—2324) **Summary of IEEE Computer Standards Committee activities.** Gustavson, D.B. (Stanford Linear Accelerator Center, CA (USA)). May 1979. Contract DE-AC03-76SF00515. 5p. (CONF-790549—9). P 02/MF A01.

From Conference on computerized data - acquisition systems in particle and nuclear physics; Santa Fe, NM, USA (14 May 1979).

The current status of standardization efforts proceedings under the IEEE Computer Standards Committee of the IEEE Computer Society is summarized as of May 1979. Names and addresses are listed as sources for further information.

52408 (UCID—30166(Pt.4)) **Computer graphics by example, Part 4. PICTURE: a picture-drawing language for the TRIX/RED report editor.** O'Hair, K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Nov 1978. Contract W-7405-ENG-48. 34p. P 03/MF A01.

PICTURE is a set of statements for drawing diagrams that are compiled by PCOMP, the Picture COMPiler, and plotted by REDPP, the TRIX/RED PostProcessor. The PICTURE/PCOMP/REDPP system is also useful for constructing slides, viewgraphs, and movie titles. This report, written for the new PICTURE user, covers, by example, the use of the most common PICTURE statements, the intermixing of text and pictures (the TRIX/RED WINDOW command), and the TRIX PICTURE and EXAMINE dialects. The examples illustrate in detail the many direct and indirect ways the user can call PCOMP and REDPP. PICTURE, the TRIX/RED report editor, PCOMP, and REDPP are available in public files on the CDC 7600 computers of the Livermore Timesharing System (the Octopus network). 6 figures, 1 table.

52409 (UCRL—82568(Rev.1)) **Architecture for support of network operating system services.** Watson, R.W.; Fletcher, J.G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Aug 1979. Contract W-7405-ENG-48. 34p. (CONF-790834—2). P 03/MF A01.

From 4. Berkeley workshop on distributed data management and computer networks; Berkeley, CA, USA (28 Aug 1979).

It is argued that network architectures should be designed with the explicit purpose of creating a coherent network operating system (NOS). The resulting NOS must be capable of efficient implementation as the base (native) operating system on a given machine or machines, or of being layered on top of existing operating systems as a guest system. The goals and elements of a network architecture to support a NOS are outlined. This architecture consists of a NOS model and three layers of protocol: an interprocess communication (IPC) layer, with an end—end protocol and lower sub-layer protocols as needed to support reliable uninterpreted logical-message communication; a service support layer (SSL), abstracting logical structures and needs common to most services, including naming, protection, request/reply structure, data-type translation, and session support; and a layer of standard services, (file, directory, terminal, process, clock, etc.). 6 figures.

52410 (Y—2184) **Digital filtering techniques for use in minicomputers.** Davenport, C.M. (Oak Ridge Y-12 Plant, TN (USA)). Aug 1979. Contract W-7405-ENG-26. 24p. P 02/MF A01.

Two digital filtering techniques are presented which are suitable for small computers (20 to 32K words of main memory). Explicit FORTRAN-coded routines are presented along with example runs. Low-pass and band-pass applications are discussed. 14 figures.

52411 **Capacitance matrix methods for the Helmholtz equation on general three-dimensional regions.** O'Leary, D.P.; Widlund, O. (National Sience Foundation Grant, University of Michigan). *Math. Comput.;* **33**: No. 147, 849-879(Jul 1979).

Capacitance matrix methods provide techniques for extending the use of fast Poisson solvers to arbitrary bounded regions. These techniques are further studied and developed with a focus on the three-dimensional case. A discrete analogue of classical potential theory is used as a guide in the design of rapidly convergent iterative methods. Algorithms and programmings aspects of the methods are also explored in detail. Several conjugate gradient methods are discussed for the solution of the capacitance matrix equation. A fast Poisson solver is developed which is numerically very stable even for indefinite Helmholtz equations. Variants thereof allow substantial savings in primary storage for problems on very fine meshes. Numerical results show that accurate solutions can be obtained at a cost which is proportional to that of the fast Helmholtz solver in use.

52412 **Numerical evaluation of a particular singular two-dimensional integral.** Monegato, G.; Lyness, J.N. (Italian Research Council). *Math. Comput.;* **33**: No. 147, 993-1002(Jul 1979).

We investigate the possibility of using two-dimensional Romberg integration to approximate integrals, over the square $0 <$ or $\approx x,y <$ or ≈ 1, of integrand functions of the form g (x, y)/x-y) where g (x, y) is, for example, analytic in x and y.We show that Romberg integration may be properly justified so long as it is based on a diagonally symmetric rule and function values on the singular diagonal, if required, are defined in a particular way. We also investigate the consequences of ignoring these function values (i.e. setting them to zero) in the context of such a calculation.We also derive the asymptotic expansion on which extrapolation methods can be based when g (x,y) has a point singularity of a specified nature at the origin.

52413 **Degenerate roots of three transcendental equations involving spherical bessel functions.** Pexton, R.L.; Steiger, A.D. *Math. Comput.;* **33**: No. 147, 1041-1048(Jul 1979).

Roots of the three transcendental equations j/sub l/(αλ) y/sub l/(λ) = j/sub l/(λ) y/sub l/(αλ), [xj/sub l/(x)]'/sub x/=αeta[xy/sub l/(x)]'/sub x/=eta =xj/sub l/(x)]'/sub x/=eta[xy/sub l/(x)]'/sub x/=αeta, and [j/sub l/(x)]'/sub x/=αμ[y/sub l/(x)]'/sub x/=μ =j/sub l/(x)]'/sub x/=μ[y/sub l/(x)]'/sub x/=αμ that are degenerate for certain values of the parameter $\alpha\epsilon$ (0,1) are presented. The symbols j/sub l/ and y/sub l/ denote the spherical Bessel functions of the first and second kind. Root degeneracies are discussed for each equation individually as well as for pairs of equations. Only positive roots are considered, sincelthe equations are invariant under the transformations λ→-λ, eta→-eta, and μ→-μ. When l=0, only the third equation has nontrivial roots. These roots are identical with the roots of the first equation for l=1, i.e.μ/sub 0n/=λ/sub 1n/ (n=1,2,...). Various graphs of λ/sub l/n, eta/sub l/n, and μ/sub l/n display root-degeneracies as intersections of curves. Accurate values of degenerate roots with the corresponding values of α are exhibited in tables.Roots of the third equation for l=1(1)30, α=0.1(0.1)0.7, together with their minima and associated values of the parameter α, are given in the microfiche supplement accompanying this issue. Roots of the first and the second equation and minima of roots of the second equation are published in v. 31 and v. 32 of this journal.The roots of the first two equations determine the eigenfrequencies of the transverse electric and the transverse magnetic normal modes of an ideal cavity resonator bounded by two concentric spheres (r=αR and r=R). The roots of the third equation determine the frequencies of the irrotational magnetic eigenfields.

52414 **Extensions of von Neumann's method for generating random variables.** Monahan, J.F. (U. S. Department of Energy). *Math. Comput.;* **33**: No. 147, 1065-1069(Jul 1979).

Von Neumann's method of generating random variables with the exponential distribution and Forsythe's method for obtaining distributions with densities of the form e/sup -G//sup(x/) are generalized to apply to certain power series representations. The flexibility of the power series methods is illustrated by algorithms for the Cauchy and geometric distributions.

52415 **Improved bivariate normal tolerance regions with some applications.** Hall, I.J.; Sheldon, D.D. (Sandia Lab, Albuquerque, NM). *J. Qual. Technol.;* **11**: No. 1, 13-19(Jan 1979).

Bivariate normal distributions have applications in areas such as product acceptance and weapon targeting, and tolerance regions can be useful in these applications. This paper gives procedures and tables for obtaining tolerance regions that are more accurate than those previously published. Some examples where tolerance regions may be useful are also included.

52416 **Cyclic data control charts.** Johnson, E.E.; Counts, R.W. (Union Carbide Corp, Oak Ridge, Tenn). *J. Qual. Technol.;* **11**: No. 1, 28-35(Jan 1979).

Cyclic data control charts have been devised for data with varying lengths of cycles and with peaks and valleys that are small and inconsequential in controlling the process. A chart of subgroup averages for controlling cycles is superimposed on a chart of individuals for controlling individuals. Range data for the subgroups give a range chart for controlling variability.

INFORMATION HANDLING

REFER ALSO TO CITATION(S) 51766, 52219

52417 (DOE/EIA—0038) **US Department of Energy guide to selected metric (SI) units and symbols.** Golby, M.E. (Department of Energy, Washington, DC (USA). Energy Information Administration). Apr 1978. 20p. NTIS, PC A02/MF A01.

A list of SI and other units and symbols used in the energy field is given to provide a reference tool for spelling, capitalization, etc. No conversion tables between metric and other units are provided. Included with the list are suggestions about how to modify some of the units and their symbols for use in those systems where character sets lack the necessary SI members and where the system output is interpreted by human beings, along with the very concise October 26, 1977, National Bureau of Standards Federal Register notice concerning US adoption of SI standards.

52418 Scientific data base management at Lawrence Livermore Laboratory: needs and a prototype system. Birss, E.W.; Jones, S.E.; Ries, D.R.; Yeh, J.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). pp 132-144 of Systemes de gestion de bases de donnees et information scientifique. Paris, France; OECD Nuclear Energy Agency (1978).

Lawrence Livermore Laboratory, with such diverse data applications as material compatibility, laser fusion, magnetic fusion, test, equation of state, weather, environmental and demographic data, has an acute need for a Scientific Data Base Management System (SDBMS). The large volume, the numeric values within an epsilon of accuracy, the unknown data relationships, the changing requirements, coupled with the overall goal of extracting new intelligence from the raw data, dictate a database system tailored toward scientific applications. Such an SDBMS should support scientific data types, a relational and user view, an interactive user language, interfaces to graphical and statistical packages, a programming language interface to existing facilities, extensibility, portability, and use in a distributed environment. A prototype of SDBMS has been implemented which uses a relational algebraic interactive user language. The software consists of a macro processor, a parser, a parser tree generator, a parser tree interpreter, semantic routines, and data base access routines. Currently, the database access routines utilize a CODASYL database system for data storage.

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In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the report title and the volume and abstract numbers. Report numbers, if applicable, are given in parentheses at the end of the entry.

DOE Energy Information Data Base: Corporate Author Entries (TID-4585) is used in the standardization of corporate entries. TID-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

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Academy of Natural Sciences of Philadelphia, PA (USA)
Life history, development processes, and energetics of the burrowing mayfly, 4:52159 (DP-MS—79-16)

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Aircraft engine future fuels and energy conservation. Lecture series, 4:51864 (AD-A—060477)

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Aerojet Energy Conversion Co., Sacramento, CA (USA)
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Aerospace Corp., El Segundo, CA (USA). Energy and Resources Div.
Jersey City energy conservation demonstration program. Final report, 4:51861 (COO—2820-1)

Aerospace Corp., El Segundo, CA (USA). Energy and Transportation Div.
Solar-powered irrigation systems. Technical progress report, July 1977—January 1978, 4:51317 (SAN—1101/PA2-21)

Aerospace Corp., El Segundo, CA (USA). Information Processing Div.
Market Penetration Model (MPM) user's guide, 4:51283 (ORNL/Sub—7525/4)
Solar total energy systems (STES) simulation program user's guide, 4:51282 (ORNL/Sub—7525/2)

Aerospace Corp., El Segundo, CA (USA). Ivan A. Getting Labs.
Transient techniques for low frequency battery impedance measurements. Interim report, 4:51759 (AD-A—060880)

Aerospace Research Corp., Roanoke, VA (USA)
Development of wood as an alternative fuel for large power generating systems. Annual report, January 3, 1978—October 31, 1978, 4:51831 (ORO—5682-8)

AeroVironment, Inc., Pasadena, CA (USA)
Assessing the local wind field for siting of wind power systems. Final report, July 1976—June 1977, 4:51415 (RLO—2441-76/16)

AiResearch Mfg. Co., Phoenix, AZ (USA)
Ceramic Technology Readiness program interim report: HiCAT conceptual design study, 4:51420 (FE—2664-T2)

Air Force Aero-Propulsion Lab., Wright-Patterson AFB, OH (USA)
Some fatigue characteristics of nickel battery plaque. Interim report, November 1977—April 1978, 4:51761 (AD-A—060370)

Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Systems and Logistics
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Alabama A and M Univ., Normal (USA)
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Alaska Univ., Anchorage (USA). Arctic Environmental Information and Data Center
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Allied Chemical Corp., Idaho Falls, ID (USA). Idaho Chemical Programs - Operations Office
Applying new safeguards technology to existing nuclear facilities, 4:51182 (CONF-790707—23)
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Material control test and evaluation system at the ICPP, 4:51181 (CONF-790707—22)

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American Society of Mechanical Engineers. New Mexico Section
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Ames Lab., IA (USA)
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Fossil Energy Program. Technical progress report, January 1—March 31, 1979. I. Mining Research and Development: Coal Preparation and Analysis, 4:50927 (IS—4703)
Fossil Energy Program. Technical progress report, October 1—December 31, 1978. I. Mining Research and Development-Coal Preparation and Analysis. II. Advanced Research and Technology Development, 4:50931 (IS—4655)

Amoco Oil Co., Naperville, IL (USA). Research and Development Dept.
Study of ebullated bed fluid dynamics for H-Coal. Quarterly progress report No. 5, December 1, 1978—February 28, 1979, 4:51009 (FE—2588-19)

Argonne National Lab., IL (USA)
Chemical Engineering Division reactor fuels and materials chemistry research: July 1976—September 1977, 4:51657 (ANL—78-15)
Fusion Power Program. Quarterly progress report, October—December 1978, 4:52360 (ANL/FPP—78-4)
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National Energy Software Center: compilation of program abstracts, 4:52398 (ANL—7411(Vol.1)(Rev.))
National Energy Software Center: compilation of program abstracts, 4:52399 (ANL—7411(Vol.2)(Rev.))
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Arizona Univ., Tucson (USA). Optical Sciences Center
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Metal silver-liquid interface: oxide properties from reflectance and scattered light spectroscopy, 4:51960 (COO—4381-7)

Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.
Erosivity of a nitramine propellant. Technical report, 4:51190 (AD-A—060590)
SOURCE: a FORTRAN-IV subroutine package that models several naturally occurring energy inputs to the mesosphere. Technical report, 4:52253 (AD-A—060612)

Atomics International Div., Canoga Park, CA (USA)
Cover gas seal components and reactor components: fuel handling. Quarterly technical progress report, January—March 1979, 4:51495 (ESG-DOE—13273)

Atomics International Div., Richland, WA (USA). Rockwell Hanford Operations
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Auburn Univ., AL (USA). Dept. of Mechanical Engineering
Improving the efficiency, safety, and utility of wood burning units. Quarterly report No. WB-4, 4:51853 (ORO—5552-4(Vol.3))

Avco Systems Div., Wilmington, MA (USA)
Arc—Coal Acetylene Process Development Program. Quarterly technical progress report No. 4, October 1—December 31, 1978, 4:51195 (COO—4507-4)

B

Babcock and Wilcox Co., Lynchburg, VA (USA). Materials and Chemical Technology Lab.
Improvement of the mechanical reliability of monolithic refractory linings for coal gasification process vessels. Quarterly progress report, July 1978—September 1978, 4:50977 (FE—2218-25)

Battelle Columbus Labs., OH (USA)
Development and evalustion of die and container materials. Fourth quarterly progress report, July 1—September 30, 1978, 4:51241 (DOE/JPL/954876—4)
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Photovoltaic concentrator application experiment, Phase I: a 150 KW photovoltaic concentrator power system for load-center applications with feedback into the utility grid. Final report, June 1, 1978—March 31, 1979, 4:51265 (DOE/CS/34267—1)
Steam—Water Mixing and System Hydrodynamics Program. Quarterly progress report, January 1—March 31, 1979, 4:51705 (NUREG/CR—0897)

Battelle Human Affairs Research Center, Seattle, WA (USA)
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Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation
Storage room design parameters for the ONWI Spent Fuel Disposal Study; nine case studies in salt, 4:51160 (ONWI—41)

Battelle-Northwest, Sequim, WA (USA). Marine Research Lab.
Food web transport of trace metals and radionuclides from the deep sea: a review, 4:52187 (PNL—2960)

Battelle Pacific Northwest Labs., Richland, WA (USA)
Development, characterization and evaluation of materials for open cycle MHD. Quarterly report for the period ending December 1978, 4:51837 (PNL—2004-10)
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Bechtel National, Inc., San Francisco, CA (USA)
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Pool-type LMFBR plant 1000 MWe Phase A-Extension-2 design. Final report, 4:51494 (EPRI-NP—1014(Vol.12))

Bettis Atomic Power Lab., West Mifflin, PA (USA)
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Bituminous Coal Research, Inc., Monroeville, PA (USA)
Gas generator research and development: BI-GAS process. Quarterly report, October—December 1978, 4:50975 (FE—1207-57)

Boeing Engineering and Construction Co., Seattle, WA (USA)
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Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)
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Boston Coll., Chestnut Hill, MA (USA)
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Bundesanstalt fuer Gewaesserkunde, Koblenz (Germany, F.R.)
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Bundesministerium fuer Forschung und Technologie, Bonn-Bad Godesberg (Germany, F.R.)
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Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Mining and Safety Research Center
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Bureau of Mines, Washington, DC (USA)
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California Univ., Davis (USA). Crocker Nuclear Lab.
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California Univ., Livermore (USA). Lawrence Livermore Lab.
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California Univ., San Diego, La Jolla (USA). Dept. of Physics
Locality principle in wave-mechanics (wave mechanics/local density of states/local partition function/cluster methods/moment methods/path integral methods). Technical report, 1 January—25 October 1978, 4:52326 (AD-A—060884)

California Univ., San Diego (USA)
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Charles River Associates, Inc., Boston, MA (USA)
Analysis of household appliance choice. Final report, 4:51852 (EPRI-EA—1100)

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Cincinnati Univ., OH (USA). Dept. of Biological Sciences
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Third interim technical report on USAFA solar test house design parameters. Report for May 1977—April 1978, 4:51297 (AD-A—060458)

Civil Engineering Lab. (Navy), Port Hueneme, CA (USA)
Performance of lead—acid gelled electrolyte batteries in the deep ocean environment. Final report, October 1977—September 1978, 4:51758 (AD-A—060422)

Clemson Univ., SC (USA)
Investigation of reliability attributes and accelerated stress factors on terrestrial solar cells. Third quarter report, June 9—September 9, 1978, 4:51244 (DOE/JPL/954929—3)

Colorado School of Mines, Golden (USA). Research Inst.
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Exploratory study of metal vapor lasers operating in the ultra-violet at kilowatt power levels. Final report, June 1, 1975—March 31, 1979, 4:52077 (COO—2723-3)

Colorado State Univ., Fort Collins (USA). Engineering Research Center
Simultaneous measurement of the thermal and electrical conductivity of Green River oil shale. Final report, June 2, 1976—August 30, 1977, 4:51134 (TID—29381)

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Columbia Gas Transmission Corp., Charleston, WV (USA)
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Report on swelling of MX-type fuels 1973/76: self-diffusion in MX-type nuclear fuels out-of-pile and in-pile, 4:52002 (EUR—5906)

Commission of the European Communities, Luxembourg
Ardennes nuclear power plant. Annual report 1975, 4:51451 (EUR—5650)
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Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center
Post-irradiation examination of a 1300°C-HTR fuel experiment Project J 96.M3, 4:51474 (EUR—5841)

Second Euratom sponsored 900°C HTR fuel irradiation experiment in the HFR Petten Project E 96.02: Pt.2. Post-irradiation examination, 4:51473 (EUR—5463)
Consolidated Controls Corp., Springfield, VA (USA)
Calculated time-correlated neutron-induced radiations in a sandstone formation. Final report, 4:51140 (GJBX—80(79))
Consumers Power Co., Jackson, MI (USA)
Fuel Performance Improvement Program. Quarterly progress report, January—March 1979, 4:51438 (COO—4066-10)
Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering
In-situ field—ion microscope study of the recovery behavior of ion-irradiated tungsten and tungsten alloys, 4:51972 (COO—3158-61)
Cornell Univ., Ithaca, NY (USA). Dept. of Theoretical and Applied Mechanics
Elongation upon torsion in a theory for the inelastic behavior of metals, 4:51926 (COO—2733-17)
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D

Dalton-Dalton-Little-Newport, Cleveland, OH (USA)
Development of a management system for implementing the NEPA process in the Department of Energy. Technical progress report, March 1, 1978—February 28, 1979, 4:51801 (COO—4750-1)
Daystar Corp., Burlington, MA (USA)
Solar water heating and data monitoring systems at South County Hospital, Wakefield, Rhode Island. Final report, 4:51316 (EPRI-ER—1078)
Defence Research Establishment Valcartier, Courcelette, Quebec (Canada)
A purely chemical HBr laser, 4:52076 (AD-A—060841)
Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center
50,000 mile methanol/gasoline blend fleet study: a progress report, 4:51895 (CONF-790520—6)
Driving cycle comparisons of energy economies and emissions from an alcohol and gasoline fueled vehicle, 4:51896 (CONF-790520—7)
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Physical properties of gasoline/alcohol automotive fuels, 4:51894 (CONF-790520—4)
Department of Energy, Grand Junction, CO (USA). Grand Junction Office
Selected references on uranium geology and potential resources of uranium, 4:51139 (GJBX—108(79))
Department of Energy, Morgantown, WV (USA). Morgantown Energy Technology Center
METC SOA test valve No. A-6: 6-inch Rockwell Nordstrom plug valve, 4:50990 (METC/RI—79/6)
Department of Energy, Washington, DC (USA)
Coal extraction and preparation technology, 4:51059 (DOE/ERD—0024)
Commercialization strategy report for advanced electric generation technologies, 4:51826 (TID—28839)
Commercialization strategy report for cogeneration, 4:51792 (TID—28853)
Department of Energy organization and functions fact book, 4:51763 (DOE/TIC—10525)
Electric utilities in Illinois, 4:51815 (CONF-7809138—)
Electrical problems committee report, 4:52368 (DOE/ET—0103)
Environmental analysis of synthetic liquid fuels, 4:51003 (DOE/EV—0044)
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Final statements for Uranium Enrichment Services Activity for fiscal year 1978, 4:51150 (ORO—770)
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Nuclear engineering enrollment and degrees, 1978: enrollments, Fall 1978, degrees granted, July 1966—June 1978, 4:51788 (DOE/IR—0053)
Radiation protection enrollments and degrees, 1978: enrollments, Fall 1978, degrees granted, July 1966—June 1978, 4:51786 (DOE/IR—0052)
Department of Energy, Washington, DC (USA). Div. of Coal Conversion
Coal demonstration plants. Quarterly report, January—March 1978, 4:50974 (DOE/ET—0069/1)
Coal liquefaction. Quarterly report, January—March 1978, 4:51002 (DOE/ET—0068/1)
Department of Energy, Washington, DC (USA). Div. of Electric Energy Systems
Systems engineering for power. Program report, 4:51821 (DOE/ET—0012/2(Rev.))
Department of Energy, Washington, DC (USA). Div. of Energy Storage Systems
Multi-year plan for Thermal and Mechanical Energy Storage program, 4:51791 (DOE/ET—0109(DRAFT))
Department of Energy, Washington, DC (USA). Div. of Fossil Fuel Extraction
Proceedings of the 5th underground coal conversion symposium, 4:50939 (CONF-790630—)
Department of Energy, Washington, DC (USA). Div. of Nuclear Power Development
UPDATE: Nuclear Power Program information and data, 4:51431 (DOE/TIC—10169)
Department of Energy, Washington, DC (USA). Energy Information Administration
Coal strike impact methodologies. Technical report, 4:51075 (DOE/EIA—0183/9)
Coal supplement No. 1 to Winter Energy Data Bulletin of December 21, 1977, 4:51096 (DOE/EIA—0007/4)
Crude petroleum, petroleum products, and natural gas liquids in P.A.D. District V: year 1976, 4:51110 (DOE/EIA—0159(76))
Evaluation of natural gas pricing proposals, 4:51124 (DOE/EIA—0102/5)
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US Department of Energy guide to selected metric (SI) units and symbols, 4:52417 (DOE/EIA—0038)
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World natural gas: 1976, 4:51121 (DOE/EIA—0133/76)
Department of Energy, Washington, DC (USA). Office of Basic Energy Sciences
Summaries of physical research in the geosciences, 4:52241 (DOE/ER—0030)
Department of Energy, Washington, DC (USA). Office of Conservation and Solar Applications
New approaches to successful vanpooling: five case studies, 4:51865 (DOE/CS—0096)
Department of Energy, Washington, DC (USA). Office of Nuclear Waste Management
Earth science technical plan for mined geologic disposal of radioactive waste, 4:51170 (TID—29018(DRAFT))
Department of Energy, Washington, DC (USA). Office of Safeguards and Security
Semi-annual report on strategic special nuclear material inventory differences, 4:51183 (DOE/DP—0001-4)
Department of Energy, Washington, DC (USA). Office of Solar, Geothermal, Electric and Storage Systems
Solar thermal power systems. Annual technical progress report, FY 1978, 4:51268 (DOE/ET—0078/T1)
Department of Transportation, Cambridge, MA (USA). Transportation Systems Center
A compilation of steady state automotive engine test data. Final report, June 1976—May 1978, 4:51885 (PB—288224)
Offshore vessel traffic management (OVTM) study. Volume II. Technical analyses. Final report, August 1977—June 1978, 4:51116 (AD-A—060476)
Offshore vessel traffic management (OVTM) study. Volume III. Appendixes. Final report, August 1977—June 1978, 4:51117 (AD-A—060503)

Drexel Univ., Philadelphia, PA (USA). Dept. of Materials Engineering
Strain hardening and ductility of iron: axisymmetric vs. plane strain elongation. Technical progress report, 4:51932 (COO—4072-2)
DSS Engineers, Inc., Fort Lauderdale, FL (USA)
Development of plastic heat exchangers for ocean thermal energy conversion. Final report, August 1976—December 1978, 4:51293 (ORO—5165-1)
Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.
In situ stress field in the southeastern United States and its implication, 4:52242 (DP-MS—78-95)
Life history, development processes, and energetics of the burrowing mayfly, 4:52159 (DP-MS—79-16)
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Eberline Instrument Corp., Santa Fe, NM (USA)
Project Gasbuggy: radiation contamination clearance report, 4:52131 (PNE-G—89)
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Limiting values for radionuclide concentration in the soil from remote spectrometer measurements, 4:52151 (EGG—1183-1716)
EG and G, Inc., San Ramon, CA (USA). Energy Measurements Group
Summary of boiling water reactor licensees' commitments to install recirculation pump trip systems, 4:51713 (UCID—18127)
Electric Power Research Inst., Palo Alto, CA (USA)
Solar heating and cooling research projects: a summary, 4:51300 (EPRI-ER—1095-SR)
Energy Conservation and Alternatives Center for Commerce and Industry, Denver, CO (USA)
Making cents of your energy dollar. Volume 1. Energy audit, 4:51856 (HCP/M5250—01/1)
Making cents of your energy dollar. Volume 2. Technical materials and references, 4:51857 (HCP/M5250—01/2)
Energy Research and Development Administration, Oak Ridge, TN (USA). Oak Ridge Operations Office
3rd ERDA energy management symposium, 4:51793 (CONF-7709114—)
Energy Research and Development Administration, Pittsburgh, PA (USA). Pittsburgh Energy Research Center
Gas turbines engines and transmissions for bus demonstration programs, 4:51886 (COO—4867-03)
Energy Technology Engineering Center, Canoga Park, CA (USA)
Energy Technology Engineering Center (ETEC). Annual technical progress report, January—December 1978, 4:51497 (ETEC—79-1)
Engineering Societies Commission on Energy, Inc., Washington, DC (USA)
Review of the borehole hydraulic coal mining system. Final report on task oil, 4:51077 (FE—2468-38)
Exxon Nuclear Co., Inc., Richland, WA (USA)
Fuel Performance Improvement Program. Quarterly progress report, January—March 1979, 4:51438 (COO—4066-10)
Exxon Research and Engineering Co., Linden, NJ (USA). Government Research Lab.
Heterostructure single crystal silicon photovoltaic cell: extension. Type A, semiconductor heterojunction silicon devices. Final report, May 15—August 10, 1978, 4:51251 (SAN—1283-9)

F

Federal Energy Administration, Washington, DC (USA)
DOD photovoltaic energy conversions systems: market inventory and analysis. Volume I, 4:51245 (DOE/TIC—10451)
Economic impact evaluation of a proposal regarding allocation of increased costs to gasoline, 4:51809 (DOE/TIC—10531)
Federal Energy Management Program, Washington, DC (USA)
Energy management in the Federal government. Annual report, to the President of the United States, fiscal year 1977, 4:51797 (DOE/S—0005)
Federal Trade Commission, Washington, DC (USA). Bureau of Competition
Solar market: proceedings of the symposium on competition in the solar energy industry, 4:51215 (CONF-771253—)
Flow Resources Corp., San Rafael, CA (USA)
Possible future environmental issues for fossil fuel technologies. Final report, 4:51060 (DOE/ET/2880—1)
Fluor Engineers and Constructors, Inc., Irvine, CA (USA)
Coal liquefaction test center. Quarterly technical progress report, April—June 1978, 4:51004 (FE—1517-71)
Coal liquefaction test center. Quarterly technical progress report, July—September 1978, 4:51005 (FE—1517-72)
Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)
Evaluation of alternative methods for the disposal of low-level radioactive wastes, 4:51166 (NUREG/CR—0680)

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Anchor stud monotonic and cyclic shear tests. Final report, 4:51555 (GA-A—15400)
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General Electric Co., Philadelphia, PA (USA). Space Div.
Development of high level electrical stress failure threshold and prediction model for small scale junction integrated circuits. Final report, 4:52104 (AD-A—060874)
General Electric Co., Pleasanton, CA (USA). Nuclear Technology Dept.
Characterization of the corrosion product films on the Dresden-1 pilot loop after re-exposure to reactor water, 4:51440 (NEDC—12691)
General Electric Co., San Jose, CA (USA). Nuclear Energy Engineering Div.
BWR blowdown/emergency core cooling program: 64-rod bundle blowdown heat transfer (8 x 8 BDHT). Final report, 4:51667 (GEAP-NUREG—23977)
General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.
Application of inertia welding technology to steel disc-type flywheels. Final report, 4:51892 (UCRL—15045)
General Electric Co., Schenectady, NY (USA). Energy Systems Programs Dept.
Fuel cell power plant integrated systems evaluation, 4:51841 (EPRI-EM—1097)

General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.
Cooperative nuclear data and methods development. Eleventh quarterly report, July—December 1978, 4:51506 (GEFR—14074-11)
Core engineering. Sixty ninth quarterly report, November 1978—January 1979, 4:51503 (GEFR—10028-69)
Critical experiments and analysis. Thirtieth quarterly report, January—March 1979, 4:51504 (GEFR—13771-30)
Internal fluid flow management analysis for Clinch River Breeder Reactor Plant sodium pumps, 4:51493 (CRBRP-GEFR-SP—139)
Pre-irradiation concept description and cost assessment, 4:51500 (GEFR—00402(Vol.1))
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Preliminary models for evaluating radiological source terms, 4:51668 (GEFR--00419)
General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.
Background noise measurements on prototype of SNR-300 steam generator in the 50 MW test facility at Hengelo, The Netherlands, 4:51499 (GEFR—00355(Rev.1))
Nuclear data and methods development and application to LMFBRs. Third annual progress report, fiscal year 1977, 4:51505 (GEFR—14073-3)
Risk allocation approach to reactor safety design and evaluation, 4:51669 (GEFR-SP—027)
General Research Corp., Santa Barbara, CA (USA)
Prospects for electric cars: electric vehicle impact assessment study. Final report, 15 December 1975—30 April 1978, 4:51888 (SAN—1180-1)
GeoEnergy Corp., Las Vegas, NV (USA)
Assessment of non-destructive testing of well casing,, cement and cement bond in high temperature wells, 4:51361 (UCRL—15032)
Geological Survey, Reston, VA (USA). Water Resources Div.
An oilspill risk analysis for the Mid-Atlantic (Proposed Sale 49) Outer Continental Shelf lease area. Water-resources investigations (final), 4:51114 (PB—288401)
Geological Survey, Washington, DC (USA)
Earth science technical plan for mined geologic disposal of radioactive waste, 4:51170 (TID—29018(DRAFT))
GeoMetrics, Inc., Sunnyvale, CA (USA)
Aerial gamma ray and magnetic survey: Powder River R and D Project. Portions of the: Forsyth and Hardin, Montana, and the Sheridan, Arminto, Newcastle, and Gillette, Wyoming Quadrangles. Final report, 4:51141 (GJBX—113(79)(Vol.1))
Aerial gamma ray and magnetic survey, Raton Basin Project. Volume II. Albuquerque Quadrangle, New Mexico. Final report, 4:51142 (GJBX—116(79)(Vol.2)(Albuquerque))
Aerial gamma ray and magnetic survey, Raton Basin Project. Volume II. Gallup Quadrangle, Arizona/New Mexico. Final report, 4:51143 (GJBX—116(79)(Vol.2)(Gallup))
Aerial gamma ray and magnetic survey, Raton Basin Project. Volume II. Shiprock Quadrangle, Arizona/New Mexico. Final report, 4:51144 (GJBX—116(79)(Vol.2)(Shiprock))
Georgia Univ., Athens (USA)
Sampling and sample handling procedures for priority pollutants in surface coal mining wastewaters, 4:51053 (ANL/EES-TM—21)
Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)
Report on the research projects in the field of reactor safety sponsored by the Federal Minister for Research and Technology. Period under report: January 1 - March 31, 1978, 4:51670 (GRS-F—63)
Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii
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r,phi,z - geometry calculation of temperature fields in porous media with spatial nonuniformity of heat release, 4:51480 (IAE—2845)
Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.
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Transformation of the P1-approximation set of equations into a diffusion equation retaining linearity of boundary conditions, 4:51550 (FEI—827)
Gould, Inc., Rolling Meadows, IL (USA). Gould Labs.
Assessment of technical and economic feasibility of zinc/bromine batteries for utility load leveling. Final report, 4:51757 (EPRI-EM—1059)
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Atlantic coastal plain geothermal test holes, Virginia: hole completion reports, 4:51357 (NVO—1558-4(Vol.1))
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Hannover Univ. (Germany, F.R.)
Interrelations between solar systems and buildings in the integration of solar collectors on roofs and walls, 4:51320 (NP—23859)
Hebrew Univ., Jerusalem (Israel)
Radiation-induced damage in E. coli B: The effect of superoxide radicals and molecular oxygen. Progress report, December 1, 1978—November 30, 1979, 4:52207 (COO—3221-56)
Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry
Partitioning of electrostatic and conformational contributions in the redox reactions of modified cytochromes c, 4:52056 (COO—3221-58)
Honeywell, Inc., Minneapolis, MN (USA). Energy Resources Center
ERDA 10 MWe solar pilot plant subsystem research experiments, steam generator tests at Northern States Power Riverside Station. Volume I. Test description and data submittal, 4:51272 (TID—29434(Vol.1))
ERDA 10 MWe solar pilot plant subsystem research experiments, steam generator tests at Northern States Power Riverside Station. Volume II. Test No. 17, 4:51273 (TID—29434(Vol.2))
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Hughes Research Labs., Malibu, CA (USA)
Arc quenching in sulfur hexafluoride gas insulated structures. Quarterly report 3, December 16, 1977—March 15, 1978, 4:51430 (SAN—1403-3)
Hull Univ. (UK). Dept. of Chemistry
Kinetics of hydrogen-oxygen and hydrocarbon-oxygen reactions. Interim report, 1 April 1977-30 June 1978, 4:51194 (AD-A—060400)

I

ICF, Inc., Washington, DC (USA)
Technical, institutional, and economic analysis of alternative electric rate designs and related regulatory issues in support of DOE Utility Conservation Programs and Policy. Volume I. Domestic rate survey, 4:51822 (HCP/B8681—01/1)
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Comparative evaluation of effects of ozonated and chlorinated thermal discharges on estuarine and fresh water organisms. First quarterly progress report, April 1979, 4:52232 (COO—4384-T1)
Idaho National Engineering Lab., Idaho Falls (USA)
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Ideamatics, Inc., Washington, DC (USA)
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Design, engineering, and evaluation of refractory liner for slagging gasifier. Second quarterly technical progress report, 4:50984 (FE—2785-T1)
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Illinois Energy Resources Commission, Springfield (USA)
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Illinois Inst. of Natural Resources, Springfield (USA)
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Precipitation chemistry trends in the northeastern United States, 4:52139 (COO—1199-55)
Illinois Univ., Chicago (USA). Energy Resources Center
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Numerical software: science or alchemy, 4:52400 (COO—2383-0059)
Illinois Univ., Urbana (USA). Dept. of Physics
Interstitial-impurity trapping in Al—Fe and Al—Zn, 4:51971 (COO—1198-1267)
Ultrasonic studies of radiation damage in an aluminum—manganese alloy, 4:51970 (COO—1198-1250)
Indian Inst. of Tech., Bombay
Evaluation of methanol for reduced exhaust emissions in a single-cylinder research engine, 4:51893 (CONF-790520—3)
Institute of Gas Technology, Chicago, IL (USA)
Coal gasification pilot plant support studies. Project 61015 (formerly 9030) quarterly report, July 1—September 30, 1978, 4:50985 (FE—2806-2)
Development of combustion data to utilize low-Btu gases as industrial process fuels. Project 61004 annual status report, October 1, 1977—September 30, 1978, 4:51094 (FE—2489-37)
Pipeline gas from coal—hydrogenation (IGT hydrogasification process). Project 9000 quarterly report No. 8 for the period April 1—June 30, 1978, 4:50980 (FE—2434-33)
Preparation of a coal conversion systems technical data book. Project 61003 annual report, May 1, 1977—April 30, 1978, 4:51025 (FE—2286-32)
Research and development of rapid hydrogenation for coal conversion to synthetic motor fuels (riser cracking of coal). Third quarter report, October 1—December 31, 1978, 4:51007 (FE—2307-46)
Institut Jozef Stefan, Ljubljana (Yugoslavia)
Burn-up calculations in nuclear power plants, 4:51432 (IJS—106/5012-77)
Cooling methods for power plants, 4:51557 (IJS—106/5019-77)
Dynamics and control of nuclear power plants, 4:51631 (IJS—106/5016-77)
Selection of suitable sites for NPP in Slovenia (stage 3), 4:51637 (IJS—106/2014-76)
Instituto de Energia Atomica, Sao Paulo (Brazil)
Calculation of reactivity of control rods in graphite moderated reactors, 4:51630 (IEA-DT—056)
Determination of the safety zones of Angra dos Reis Nuclear Power Plant, according to the model of radion diffusion in the atmosphere, 4:51679 (IEA-DT—058)

Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)
Investigation and development of UO_2 fuel pins in "Boris Kidric" Institute, 4:51981 (IBK—1442)
Intermagnetics General Corp., Guilderland, NY (USA)
Magnet optimization for pulsed energy conversion, 4:52371 (SAND—79-1234C)

J

Japan Atomic Energy Research Inst., Tokyo
Calculation of stress intensity factor at crack tip. Preliminary calculation by FEM and LFM for analysis of PCI experiment, 4:51600 (JAERI-M—7716)
LWR containment spray iodine removal calculation code. MIRA-PB, 4:51680 (JAERI-M—7594)
Overview of Japanese seismic research program for HTR, 4:51481 (JAERI-M—7728)
Prediction of ROSA-III experiment. RUN 701, 4:51681 (JAERI-M—7712)
Jet Propulsion Lab., Pasadena, CA (USA)
High-efficiency thin-film GaAs solar cells. Final report, 4:51247 (JPL-PUB—79-38)
Photovoltaic solar panel resistance to simulated hail. Low-Cost Solar Array Project, 4:51233 (DOE/JPL—1012-78/2)
Joint Inst. for Lab. Astrophysics, Boulder, CO (USA)
Research in laser processes. Semiannual report, 1 February—31 July 1978, 4:52075 (AD-A—060761)

K

Karnatak Univ., Dharwar (India)
Evaluation of methanol for reduced exhaust emissions in a single-cylinder research engine, 4:51893 (CONF-790520—3)
Kennedy Van Saun Corp., Danville, PA (USA)
Developing/modifying coal grinding procedures and equipment to produce predictable size distributions during coal preparation. Quarterly progress report, April—June 1978, 4:51082 (FE—2475-22)
Kentucky Geological Survey, Henderson (USA)
Studies of New Albany shale in western Kentucky. Final report, December 1, 1977—November 30, 1978, 4:51120 (ORO—8215-1)
Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research
Proceedings of third Kentucky coal refuse disposal and utilization seminar, 4:51046 (IMMR—32-M4-77)
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)
Property changes in graphite irradiated at changing irradiation temperature, 4:52021 (GA-A—15270)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)
Methods for the on-line-optimization of the steady-state-behavior of nonlinear processes with slow dynamics, 4:52403 (KFK-PDV—159)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente
Contribution to a theory of two-phase flow with phase change and addition of heat in a coolant channel of a LWR-fuel element during a loss-of-coolant accident, 4:51683 (KFK—2657)
Theoretical investigations of the gas flow in ballooning LWR-fuel rods, 4:51682 (KFK—2656)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Internationales Buero/Uebersetzergruppe
Some problems of operation behaviour of hexagonal boxes for fuel elements of fast power reactors, 4:51513 (KFK-tr—578)
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit
Contribution to a theory of two-phase flow with phase change and addition of heat in a coolant channel of a LWR-fuel element during a loss-of-coolant accident, 4:51683 (KFK—2657)
Theoretical investigations of the gas flow in ballooning LWR-fuel rods, 4:51682 (KFK—2656)
Kinetics Technology International Corp., Pasadena, CA (USA)
Assessment of fuel processing systems for dispersed fuel cell power plants, 4:51840 (EPRI-EM—1010)
Kozponti Fizikai Kutato Intezet, Budapest (Hungary)
Experimental high pressure water loops Pt. 1. General description, 4:51454 (KFKI—1977-108)
Steady state and transient critical heat flux examinations, 4:51455 (KFKI—1977-115)

L

Lamar Univ., Beaumont, TX (USA). Dept. of Chemical Engineering
Process feasibility study in support of silicon material task 1. Quarterly technical progress report (XIII), September—December 1978, 4:51234 (DOE/JPL/954343—13)
Long Beach, City of, CA (USA)
Pilot demonstration of enhanced oil recovery by micellar polymer waterflooding, phase B. Quarterly report, third quarter 1978, 4:51103 (SAN—1395-26)
Los Alamos Scientific Lab., NM (USA)
Architecture and dynamics of isotopically labelled macromolecules by nuclear magnetic resonance spectroscopy, 4:52193 (LA-UR—79-1648)
Calibration of a rapid quench vessel, 4:52068 (LA—7904-MS)
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Flow cytometric methods for assaying damage to respiratory tract cells, 4:52233 (LA-UR—79-1955)
Further studies of long-term ecological effects of exposure to uranium. Final report, 1 October 1976—30 September 1977, 4:52154 (AD-A—060487)
Gamma doses from irradiated assemblies under water, 4:51439 (LA—7914-MS)
General-purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program. Progress report, May 1979, 4:51192 (LA—7952-PR)
Hot dry rock geothermal heat extraction, 4:51398 (LA-UR—79-1920)
Magnetic behavior at the iron sites in Pd Fe Mn alloys, 4:51946 (LA-UR—79-2094)
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NEPS reactor and heat exchanger. Summary status (December 1978), 4:51656 (LA—7711-MS)
New instrument for the confirmation of declared power histories of central station nuclear power plants, 4:51433 (LA-UR—79-1879)
Nuclear reactor safety. Quarterly progress report, January 1—March 31, 1979, 4:51704 (NUREG/CR—0868)
Overview and status of the SIMMER testing program, 4:51684 (LA-UR—79-1874)
Reactor technology. Progress report, January—March 1979, 4:51551 (LA—7878-PR)
Research and development related to the Nevada Nuclear Waste Storage Investigations. Progress report, January 1—March 31, 1979, 4:51165 (LA—7900-PR)
Single particle analysis with a 360° light scattering photometer, 4:52107 (LA—7886-T)
Tomographic visualization of stress corrosion cracks in tubing, 4:51558 (LA—7891-MS)
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M

Maryland Univ., College Park (USA). Dept. of Physics and Astronomy
Cyclotron maser instability for general magnetic harmonic number, 4:52073 (AD-A—060379)
Stability properties of a cylindrical rotating p-layer immersed in a uniform background plasma, 4:52341 (AD-A—060378)

Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)
Analysis of TATB/Phenoxy formulations by HSLC. Process Development Endeavor No. 210, 4:52124 (MHSMP—79-39)
Substitute potting compounds for Sylgard 93-120. Process Development Endeavor Nos. 203 and 207, 4:52123 (MHSMP—79-37)

Massachusetts Inst. of Tech., Cambridge (USA)
Martensitic transformation in high magnetic fields, 4:51913 (HEDL-SA—1689)

Masssachusetts Inst. of Tech., Cambridge (USA). Dept. of Mechanical Engineering
A two-dimensional fluid finite element. Final report, 1 October 1976—30 September 1977, 4:51708 (PB—289121)

Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering
Interfacial effects in fast reactors, 4:51543 (COO—2250-37)

Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.
Independent assessment of energy policy models, 4:51772 (EPRI-EA—1071)
Medium and high temperature gas clean-up of particulates. Quarterly progress report, January—March 1979, 4:50934 (FE—2295-32-6)

Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.
Classification and technical review of dc-ac inverters for use in photovoltaic power systems, 4:51265 (COO—4094-25)
Evaluation of combined photovoltaic/thermal collectors, 4:51318 (COO—4577-8)
Flywheel components for satellite applications. Technical note, 4:51751 (AD-A—060586)

Mathtech, Inc., Princeton, NJ (USA)
Reference Materials System: materials policy information system, 4:51766 (BNL—26446)

Maxwell Labs., Inc., Woburn, MA (USA)
Magnetohydrodynamic lightweight channel development. Final report, 28 November 1975—31 December 1977, 4:51838 (AD-A—060429)

McAlvey (Robert F. III) and Associates, Hoboken, NJ (USA)
Impact of flywheel-transmissions on automobile performance: a logical basis for evaluation, 4:51890 (UCRL—52758)

Mechanical Technology, Inc., Latham, NY (USA)
Conceptual design study of an automotive Stirling reference engine system, 4:51887 (DOE/NASA/0032—79/1)
Development of a high temperature solar powered water chiller. Volume II. Phase I technical progress report, September 26, 1977—June 1, 1978, 4:51301 (SAN—1590-1/2)
Helium circulators. Phase 2. Performance test report, 4:51483 (ORNL/SUB—76250/2)

Metal Properties Council, Inc., New York (USA)
Program to discover materials suitable for service under hostile conditions obtaining in equipment for the gasification of coal and other solid fuels. Quarterly progress report, July 1—September 30, 1978, 4:50976 (FE—1784-45)

Mezinarodni Hydrogeologica Asociace, Prague (Czechoslovakia)
International symposium on groundwater pollution by oil hydrocarbons, 4:52160 (CONF-7806143—)

Michigan State Univ., East Lansing (USA). Dept. of Botany and Plant Pathology
Carbonic anhydrase levels and internal lacunar CO_2 concentrations in aquatic macrophytes, 4:52192 (COO—1599-153(Pt.4))

Michigan State Univ., Hickory Corners (USA). W.K. Kellogg Biological Station
Dissolved organic matter and lake metabolism. Technical progress report, 1 July 1978—30 Jun 1979, 4:52225 (COO—1599-153(Pt.1))

Ministry of Trade and Industry (Finland)
Information on the fundamental improvement of a private home: save money, energy, and this guide, 4:51850 (DOE-tr—185)

Minnesota Univ., Minneapolis (USA)
Vertebrate behavior and ecology. Progress report, 1 July 1978—30 June 1979, 4:52191 (COO—1332-131)

Minnick (L.J.), Inc., Plymouth Meeting, PA (USA)
Development of potential uses for the residue from fluidized bed combustion processes. Quarterly technical progress report, September—November 1978, 4:51877 (TID—29305)

Mission Research Corp., Santa Barbara, CA (USA)
Inclusion of earth reflected fields in the high altitude EMP code LHAP. Topical report, 3 January 1977—31 March 1978, 4:52254 (AD-A—060797)

Mitre Corp., McLean, VA (USA)
Reviews of the environmental effects of pollutants. XIII. Endrin, 4:52234 (ORNL/EIS—131)

Mobil Research and Development Corp., Paulsboro, NJ (USA)
Gasifier study for Mobil coal to gasoline processes. Final report, 4:51010 (FE—2766-13)

Motorola, Inc., Phoenix, AZ (USA)
Thin films of silicon on low-cost substrates. Final report, 4:51252 (SAN—1287-2)

Mueller Associates, Inc., Baltimore, MD (USA)
Status of alcohol fuels utilization technology for stationary gas turbines, 4:51205 (HCP/M2098—03)

N

National Academy of Sciences - National Research Council, Washington, DC (USA)
Geochemistry and the environment. Volume III. Distribution of trace elements related to the occurrence of certain cancers, cardiovascular diseases, and urolithiasis, 4:52222 (COO—2718T015-1)

National Bureau of Standards, Washington, DC (USA). Center for Building Technology
Laboratories technically qualified to test solar collectors in accordance with ASHRAE Standard 93-77: summary report, 4:51319 (NBSIR—78-1535)

National Bureau of Standards, Washington, DC (USA). Center for Materials Science
Development, testing and evaluation of MHD-materials. Quarterly report, April—June 1978, 4:51836 (FE—6010-12)

National Bureau of Standards, Washington, DC (USA). Center for Radiation Research
Minutes of the third annual meeting of the Panel on Reference Nuclear Data, 4:52303 (BNL-NCS—51023)

National Climatic Center, Asheville, NC (USA)
National wind data index. Final report, 4:51408 (HCO/T1041—01)

National Congress of Petroleum Retailers, Washington, DC (USA)
Energy cost reduction for gasoline service stations, 4:51862 (DOE/TIC—10206)

National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)
Solar-geophysical data number 410, October 1978, Part I (Prompt reports). Data for September 1978, August 1978, 4:52249 (PB—289935)
Solar—geophysical data number 410, October 1978. Part II. (Comprehensive reports). Data for April 1978—March 1978 and miscellanea, 4:52250 (PB—289936)

National Oceanic and Atmospheric Administration, Miami, FL (USA). Atlantic Oceanographic and Meteorological Labs.
Seismic reflection profiles of the United States east coast continental margin. Technical report, 4:52245 (PB—289786)

National Oceanic and Atmospheric Administration, Washington, DC (USA)
Automated prediction of boundary layer winds and turbulence for the Savannah River Laboratory. Final report, 4:52135 (NOAA-TR-NWS—1007-1)

National Technical Information Service, Springfield, VA (USA)
Carbon monoxide lasers (citations from the NTIS data base). Report for 1964—December 1978, 4:52079 (NTIS/PS—78/1319)
Carbon monoxide lasers. Volume 1. 1970-December 1977 (citations from the Engineering Index data base). Report for 1970—December 1977, 4:52080 (NTIS/PS—78/1320)
Carbon monoxide lasers. Volume 2. January—December 1978 (citations from the Engineering Index data base). Report for January—December 1978, 4:52081 (NTIS/PS—78/1321)
Optical coatings for solar cells and solar collectors (citations from the NTIS data base). Report for 1964—October 1978, 4:51321 (NTIS/PS—78/1341)

Optical coatings for solar cells and solar collectors (citations from the Engineering Index data base). Report for 1970—December 1978, 4:51322 (NTIS/PS—78/1342)
Stress corrosion of stainless steels. Volume 1. 1964—1976 (citations from the NTIS data base). Report for 1964—1976, 4:51963 (NTIS/PS—78/1338)
Stress corrosion of stainless steels. Volume 2. 1977—1978 (citations from the NTIS data base). Report for 1977—1978, 4:51964 (NTIS/PS—78/1339)

Naval Research Lab., Washington, DC (USA)
A conceptual design for an imploding-liner fusion reactor (LINUS). Interim report, 4:52359 (AD-A—060588)
Collisional emittance growth in the particle simulation of focused beam transport. Interim report, 4:52256 (AD-A—060739)
Cooperative Radiation Effects Simulation Program. Semiannual progress report, 1 March—31 August 1977, 4:51969 (AD-A—060748)
Effect of heat treatment on fatigue crack propagation and deformation mode in Alloy 718 at elevated temperatures. Interim report, 4:51924 (AD-A—060741)
High transition temperature superconductors - V_3Ga wire development. Annual report, 4:51941 (AD-A—060713)
Linear stability of self-similar flow. 4. Convective instability of a spherical cloud expanding into vacuum. Interim report, 4:52342 (AD-A—060835)
S201 far-ultraviolet atlas of the Large Magellanic Cloud. Interim report, 4:52251 (AD-A—060437)

Nevada Univ., Reno (USA). Dept. of Chemistry
Molecular energy transfer studies. Final report, 1 October 1976—31 July 1978, 4:52268 (AD-A—060616)

New Mexico Energy and Minerals Dept., Santa Fe (USA)
State energy conservation plan for New Mexico, 4:51846 (CONS—8180-T1)

New Mexico Univ., Albuquerque (USA). Eric H. Wang Civil Engineering Research Facility
Dynamic airblast simulator (DABS) instrumentation development. Phase I. Final report, 4:52129 (AD-A—060732)

New York Univ., NY (USA). Dept. of Environmental Medicine
Tumorigenic action of beta, proton, alpha and electron radiation on the rat skin. Progress report, August 1, 1977—January 31, 1979, 4:52217 (COO—3380-T1)

North Dakota Regional Environmental Assessment Program, Bismarck (USA)
ND-REAP/DOE cooperative project: final report, 4:51784 (DOE/ET—2720-1)

Northrop Research and Technology Center, Palos Verdes Peninsula, CA (USA)
Lifetime and diffusion length measurements on silicon material and solar cells, 4:51237 (DOE/JPL/954614—1)

Northrop Services, Inc., Huntsville, AL (USA)
Solar-climatic statistical study, 4:51214 (HCP/T4016—01/2)

Northwestern Univ., Evanston, IL (USA). Dept. of Mechanical Engineering and Astronautical Sciences
Theoretical studies on heterogeneous combustion. Progress report, March 1, 1978—February 28, 1979, 4:52065 (COO—4433-2)

Notre Dame Univ., IN (USA). Dept. of Metallurgical Engineering and Materials Science
Microstructural effects in abrasive wear. Quarterly progress report, December 15, 1978—March 15, 1979, 4:51912 (COO—4246-8)

Nuclear Regulatory Commission, Washington, DC (USA)
Anticipated transients without scram for light water reactors. Volume 3. Staff report, 4:51709 (PB—289543)
Construction status report. Nuclear power plants, data as of April 30, 1979, 4:51537 (NUREG—0030(Vol.2)(No.2))
Licensed operating reactors. Operating units status report, data as of 6-30-79, 4:51536 (NUREG—0020(Vol.3)(No.7))

Nuclear Regulatory Commission, Washington, DC (USA). Advisory Committee on Reactor Safeguards
Comments on the NRC Safety Research Program budget, 4:51687 (NUREG—0603)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research
Review group meeting on two-phase flow instrumentation, 4:51688 (NUREG/CP—0006)

O

Oak Ridge Associated Universities, Inc., TN (USA)
Interaction of platinum compounds with the genome: correlation between DNA binding and biological effects, 4:52228 (CONF-790486—1)

Oak Ridge Gaseous Diffusion Plant, TN (USA)
Hydrogeochemical and stream sediment reconnaissance basic data for Amarillo NTMS quadrangle, Texas, 4:51147 (K/UR—125)

Oak Ridge National Lab., TN (USA)
Alloy development for irradiation performance. Quarterly progress report for period ending March 31, 1979, 4:52387 (DOE/ET—0058/5)
Analysis of the ORNL/TSF GCFR Grid-Plate Shield Design Confirmation Experiment, 4:51516 (ORNL—5551)
Analysis of the ZPR-9 reverse approach to critical (RAC) low level flux monitor experiment, 4:51652 (ORNL—5181)
Assessment of the corrosiveness of cellulosic insulating materials, 4:52020 (ORNL/SUB—7556/1)
Biomedical and environmental aspects of the thorium fuel cycle: a selected, annotated bibliography, 4:52152 (ORNL/EIS—111)
Breeder Reactor Safety and Core Systems Programs progress report for October—December 1978, 4:51706 (ORNL/TM—6851)
Cement technology for plugging boreholes in radioactive waste repository sites. Progress report, October 1, 1977—September 30, 1978, 4:51167 (ORNL—5524)
CHO/HGPRT mutagenicity assay. I. Experimental procedure, 4:52198 (CONF-790537—4)
CHO/HGPRT mutagenicity assay. III. Adaptation for mutagen screening, 4:52195 (CONF-790537—1)
CHO/HGPRT mutation assay. IV. Progress with quantitative mutagenesis and mutagen screening, 4:52231 (CONF-790537—2)
Comparison of two procedures for evaluating the economics of industrial power plants, 4:51870 (ORNL/TM—6872)
DOE/ORNL demonstrations of load management by controlled customer-side thermal energy storage, 4:51753 (CONF-790748—1)
Economic-engineering energy-demand model for the pulp and paper industry. Phase I report, 4:51866 (ORNL/CON—29)
Electron spectroscopic investigations of the oxidation of beryllium, 4:51947 (SAND—79-0791C)
Elevated temperature exposure has significant effects on the structure of austenitic stainless steel welds, 4:51925 (CONF-790736—1)
Evaluation of fuel fabrication and the back end of the fuel cycle for light-water- and heavy-water-cooled nuclear power reactors, 4:51540 (ORNL/TM—6685)
Evaluation of selected predictive models and parameters for the environmental transport and dosimetry of radionuclides, 4:52153 (ORNL/TM—6663)
Fossil energy program. Progress report for October 1978, 4:50929 (ORNL/TM—6666)
Fossil energy program. Quarterly progress report for the period ending December 31, 1978, 4:50928 (ORNL—5520)
Gas-cooled reactor programs: High-Temperature Gas-cooled Reactor Base-Technology Program. Annual progress report for period ending December 31, 1978, 4:51482 (ORNL—5536)
High voltage research (breakdown strengths of gaseous and liquid insulators) and environmental effects of dielectric gases. Semiannual report, October 1, 1978—March 31, 1979, 4:51429 (ORNL/TM—6902)
Industrial Energy Use: a selected bibliography, 4:51867 (ORNL/EIS—152)
INGDOS: a conversational computer code to implement US Nuclear Regulatory Commission Regulatory Guide 1.109 models for estimation of annual doses from ingestion of atmospherically released radionuclides in foods, 4:52219 (ORNL/TM—6571)
Input data requirements for special processors in the computation system containing the VENTURE neutronics code, 4:51515 (ORNL—5229/R1)
Interaction of platinum compounds with the genome: correlation between DNA binding and biological effects, 4:52228 (CONF-790486—1)

Lecture notes on ordinary differential equations software, user's guides for ODE, RKF45, GEAR, and EPISODE, 4:52405 (ORNL/CSD/TM—64)
Mathematical modeling of phase change processes for latent heat thermal energy storage, 4:51754 (ORNL/CSD—39)
Mineral cycling in tropical forests. Environmental Sciences Division publication No. 1269, 4:52146 (CONF-7808112—1)
Multirod burst test program. Progress report, January—March 1979, 4:51699 (NUREG/CR—0817)
NFREYA: a Monte Carlo beam deposition code for noncircular tokamak plasmas, 4:52337 (ORNL/TM—6845)
Nondestructive testing development program semiannual progress report for period ending March 31, 1979, 4:51517 (ORNL/BRP—79/3)
Oxide particle size distribution from shearing irradiated and unirradiated LWR fuels in Zircaloy and stainless steel cladding: significance for risk assessment, 4:51156 (NUREG/CR—0866)
Radiation toxicology, 4:52208 (CONF-790486—6)
Real time material accountability in a chemical reprocessing unit, 4:51180 (CONF-790707—17)
Relationship between repair processes and mutation induction in bacteria, 4:52224 (CONF-790676—1)
Repair and cell cycle response in cells exposed to environmental biohazards. Progress report, October 1, 1976—May 31, 1979, 4:52218 (ORO—4568-20)
Report of the proceedings of the OTEC alternate cycles contractors' information exchange meeting, 4:51285 (CONF-780934—)
Socioeconomic impacts of nuclear power plants: a paired comparison of operating facilities, 4:51635 (NUREG/CR—0916)
Status of transactinium nuclear data in the Evaluated Nuclear Structure Data File, 4:52316 (DOE/TIC—10197)
Study of the Cherokee Nuclear Station: projected impacts, monitoring plan, and mitigation options for Cherokee County, South Carolina, 4:51456 (ORNL/TM—6804)
Testing of bellows for engineering systems. Part 1, 4:51193 (ORNL/TM—6887)
Toward a comprehensive theory of radiation-induced swelling and creep - the point defect concentrations, 4:51897 (CONF-790657—1)
Toxic materials control program at ORNL revisited, 4:52236 (CONF-790569—1)
Two-phase flow measurements with advanced instrumented spool pieces and local conductivity probes, 4:51660 (CONF-790745—1)
White-tailed deer (Odocoileus virginianus) on the Department of Energy's Oak Ridge Reservation: data on road-killed animals, 1969—1977, 4:52157 (ORNL/TM—6803)

Oak Ridge Y-12 Plant, TN (USA)
Digital filtering techniques for use in minicomputers, 4:52410 (Y—2184)
Progress report on installing DYMCAS in the Oak Ridge Y-12 Plant, 4:51188 (Y/DG—10-746)

Occidental Oil Shale, Inc., Grand Junction, CO (USA)
Occidental vertical modified in situ process for the recovery of oil from oil shale, phase 1. Quarterly progress report, May 1—July 31, 1978, 4:51133 (TID—28943)

O'Donnell and Associates, Inc., Pittsburgh, PA (USA)
Creep tensile instability, 4:51523 (WARD-SD—94000-1)

Oklahoma State Univ., Stillwater (USA). Dept. of Chemistry
Characterization of coal-derivediquids and other fossil fuel related materials employing mass spectrometry. Quarterly report, March 30—June 29, 1979, 4:51008 (FE—2537-11)
Characterization of high boiling fossil fuel distillates via ^{1}H and ^{13}C NMR analysis. Quarterly report IV, April 1—June 30, 1979, 4:51119 (DOE/BC/30101—4)

P

Pennsylvania State Univ., University Park (USA)
Heterostructure single crystal silicon photovoltaic solar cells. Fifth quarterly report, October 1—December 31, 1977, 4:51259 (TID—28931)
Studies of mechanical properties and irradiation damage nucleation of HTGR graphites. Progress report, February 1, 1978—March 31, 1979, 4:51472 (COO—2712-6)

Pennsylvania State Univ., University Park (USA). Center for Air Environment Studies
Air pollution effects on food quality. 2nd annual progress report, 4:52226 (COO—4331-2)

Phillips Petroleum Co., Homer City, PA (USA)
Gas generator research and development: BI-GAS process. Quarterly report, October—December 1978, 4:50975 (FE—1207-57)

Physical Sciences, Inc., Woburn, MA (USA)
Coal processing for fuel cell application. Task III: fluidized bed gasifier model. Task report, July 1—October 31, 1978, 4:50991 (TID—29302)

Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Radioaktivitaet
Emission of radioactive substances in gaseous wastes from nuclear and fossil-fuel power plants. A comparison of radiation load, 4:51423 (PTB-Ra—8)

Pope, Evans and Robbins, Inc., New York (USA)
Multicell fluidized bed boiler design construction and test program. Quarterly progress status report, January—March 1979, 4:52089 (DOE/ET/1237—01/15)

Portland Cement Association, Skokie, IL (USA)
Use of precalciners to remove alkalies from raw materials in the cement industry. Quarterly technical progress report, February—April 1979, 4:52007 (COO—4929-3)

Portland Cement Association, Skokie, IL (USA). Construction Technology Labs.
Sulfate specifications as a constraint to gypsum addition to cement and possible replacement of gypsum as an additive. Quarterly technical progress report, September—October—November 1978, 4:52008 (COO—5011-1)
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Systems, Science and Software, La Jolla, CA (USA)
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Utah Univ., Salt Lake City (USA). Inst. for Biomedical Engineering
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The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed.

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	4:52056	COO—3221-58
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	4:51440	NEDC—12691
EY-76-C-02-4094	**Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.**	
	4:51265	COO—4094-25
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EY-76-C-03-0167-023	**General Atomic Co., San Diego, CA (USA)**	
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EY-76-C-03-0167-050	**General Atomic Co., San Diego, CA (USA)**	
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EY-76-C-03-0167-061	**General Atomic Co., San Diego, CA (USA)**	
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EY-76-C-03-0824-011	**Atomics International Div., Canoga Park, CA (USA)**	
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EY-76-C-03-0824-012	**Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group**	
	4:51496	ESG-DOE—13275
EY-76-C-03-0893-001	**General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.**	
	4:51493	CRBRP-GEFR-SP—139
EY-76-C-03-0893-019	**General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.**	
	4:51669	GEFR-SP—027
EY-76-C-03-0893-021	**General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.**	
	4:51505	GEFR—14073-3
EY-76-C-03-0893-030	**General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.**	
	4:51499	GEFR—00355(Rev.1)
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	4:51500	GEFR—00402(Vol.1)
	4:51501	GEFR—00402(Vol.2)
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	4:51503	GEFR—10028-69
	4:51504	GEFR—13771-30
	4:51506	GEFR—14074-11
EY-76-C-03-0893-032	**General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.**	
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EY-76-C-03-1101-002	**Aerospace Corp., El Segundo, CA (USA). Energy and Transportation Div.**	
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	4:51272	TID—29434(Vol.1)
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	4:51160	ONWI—41
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	4:51559	NUREG/CR—0910
	4:51702	NUREG/CR—0855
	4:51705	NUREG/CR—0897
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	4:51142	GJBX—116(79)(Vol.2)(Albuquerque)
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EY-76-S-02-2874	**Columbia Univ., New York (USA). Dept. of Mathematical Statistics**	
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2	4:52320	*See* LBL-9468
CONF-790745-		(Reactor Safety Instrumentation Review Group meeting, Silver Spring, MD, USA, 24-27 Jul 1979)
1	4:51660	Dep. NTIS, PC A03/MF A01
2	4:51553	Dep. NTIS, PC A03/MF A01
CONF-790748-		(Conference on peak load pricing and thermal energy storage, Chicago, IL, USA, 15-17 Jul 1979)
1	4:51753	Dep. NTIS, PC A02/MF A01
CONF-790749-		(Conference on advanced materials for alternate fuel capable directly fired heat engines, Castine, ME, USA, 30 Jul-3 Aug 1979)
1	4:51965	*See* SAND-79-1493C
CONF-790754-		(Symposium on renewable resources: a systematic approach, Saltillo, Mexico, 31 Jul 1979)
1	4:51766	*See* BNL-26446
CONF-790802-		(International conference on structural mechanics in reactor technology, Berlin, F.R. Germany, 13-17 Aug 1979)
22	4:52364	*See* GA-A-15335
CONF-790805-		(DOE symposium on enhanced oil and gas recovery and improved drillings technology, Tulsa, OK, USA, 22-24 Aug 1979)
3	4:52246	*See* SAND-79-0868C
CONF-790809-		(International conference on solid state devices, Tokyo, Japan, 27-29 Aug 1979)
1	4:52119	*See* SAND-79-0603C
CONF-790813-		(14. annual meeting of the Microbeam Analysis Society, San Antonio, TX, USA, 13-17 Aug 1979)
4	4:51189	*See* UCRL-82408
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5	4:52367	*See* GA-A-15475
9	4:51942	*See* BNL-26391
CONF-790816-		(International meeting on fast reactor safety technology, Seattle, WA, USA, 19-23 Aug 1979)
16	4:51684	*See* LA-UR-79-1874
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7	4:51169	*See* SAND-79-1113C
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3	4:52204	*See* LBL-9300
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2	4:52409	*See* UCRL-82568(Rev.1)
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1	4:51884	*See* LBL-9423
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1	4:51554	Dep. NTIS, PC A02/MF A01
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1	4:51824	*See* LBL-9233
CONF-790903-		(5. international conference on erosion by liquid and solid impact, Cambridge, UK, 3-5 Sep 1979)
1	4:51982	*See* SAND-78-2294C
CONF-790905-		(American Society for Quality Control conference, Las Vegas, NV, USA, 24-26 Sep 1979)
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8	4:51398	*See* LA-UR-79-1920
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18	4:51370	*See* UCRL-82871
CONF-790908-		(AGARD meeting, Spatind, Norway, 10-14 Sep 1979)
1	4:52333	*See* UCRL-82121
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2	4:51946	*See* LA-UR-79-2094
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1	4:51271	*See* SAND-79-1588C
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1	4:51542	*See* GA-A-15494
CONF-791007-		(Energy systems analysis international conference, Dublin, Ireland, 9-11 Oct 1979)
1	4:51767	*See* BNL-26472
CONF-791008-		(ASNT fall conference, St Louis, MO, USA, 15-19 Oct 1979)
1	4:51428	*See* BNL-26425
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3	4:51871	*See* BNL-26482
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4618-1(Vol.2)	4:51939	Plenum Press, New York, NY
4618-(Vol.1)	4:51899	New York, NY; Plenum Press (1979).
4750-1	4:51801	Dep. NTIS, PC A11/MF A01
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106/2014-76	4:51637	Dep. NTIS (US Sales Only), PC A09/MF A01
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106/5016-77	4:51631	Dep. NTIS (US Sales Only), PC A07/MF A01
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79-1874	4:51684	Dep. NTIS, PC A02/MF A01
79-1879	4:51433	Dep. NTIS, PC A02/MF A01
79-1920	4:51398	Dep. NTIS, PC A02/MF A01
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23789	4:51802	NTIS
23790	4:51806	NTIS, PC A03/MF A01
23803	4:51312	Grand Forks, ND; North Dakota University (1977).
23805	4:51331	Grand Forks, ND; North Dakota University (1977).
23806	4:51313	Grand Forks, ND; North Dakota University (1977).
23812	4:51799	Baton Rouge, LA; Department of Natural Resources (1978).
23836	4:51230	Sacramento, CA; California Energy Commission (1978).
23845	4:51097	Dep. NTIS (US Sales Only), PC A05/MF A01
23849	4:51352	Geological Literature Center, Tokyo, Japan 50 yen per sheet
23858	4:51825	New York, NY; New York State Energy Office (1978).
23859	4:51320	Dep. NTIS (US Sales Only), PC A10/MF A01
23879	4:51072	Lincoln, NE; Univ. of Nebraska (1977).

Report No.	Abstract No.	Availability
23880	4:52223	Dep. NTIS (US Sales Only), PC A04/MF A01
NTIS/PS-		
78/1319	4:52079	NTIS PCN01/MF N01
78/1320	4:52080	NTIS PCN01/MF N01
78/1321	4:52081	NTIS PCN01/MF N01
78/1338	4:51963	NTIS PCN01/MF N01
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78/1341	4:51321	NTIS PCN01/MF N01
78/1342	4:51322	NTIS PCN01/MF N01
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8215-1	4:51120	Dep. NTIS, PC A04/MF A01
PATENTS-US-		(US: Commissioner of Patents, Washington, D.C. 20231, USA, $.50 per copy. Government Patent Applications available from NTIS)
A 854,444	4:52120	
A 934,764	4:52096	
A 942,227	4:52384	
4,091,133	4:52082	
4,105,397	4:51878	
4,131,485	4:51326	
4,138,320	4:51633	
4,138,622	4:52087	
4,139,724	4:51561	
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4,140,343	4:51135	
4,142,595	4:51104	
4,142,876	4:51122	
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0326/33-1	4:52199	Dep. NTIS, PC A02/MF A01
1101/PA2-21	4:51317	Dep. NTIS, PC A08/MF A01
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78-2294C	4:51982	Dep. NTIS, PC A02/MF A01
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79-0677C	4:51442	Dep. NTIS, PC A02/MF A01
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79-0932C	4:52369	Dep. NTIS, PC A02/MF A01
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77-1978	4:51849	Dep. NTIS (US Sales Only), PC A05/MF A01
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3-78/19	4:51325	Dep. NTIS (US Sales Only), PC A03/MF A01
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78/81	4:51880	Dep. NTIS (US Sales Only), PC A06/MF A01
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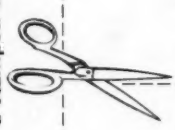

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